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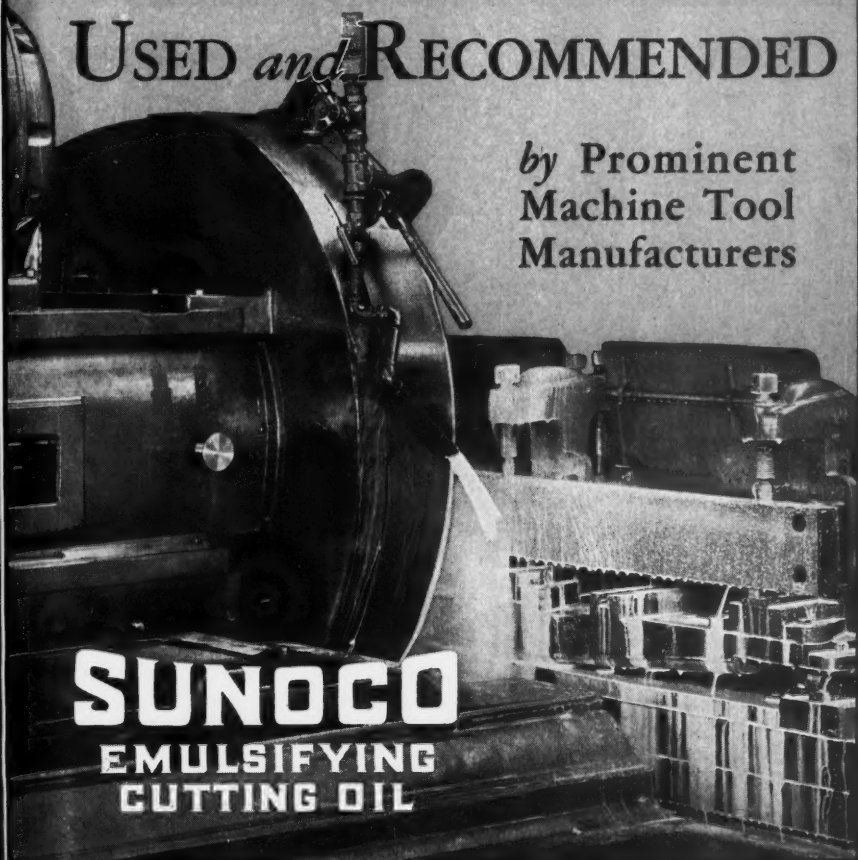
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March, 1931

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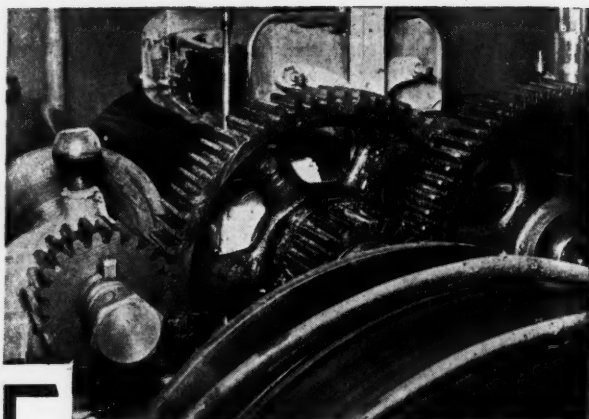
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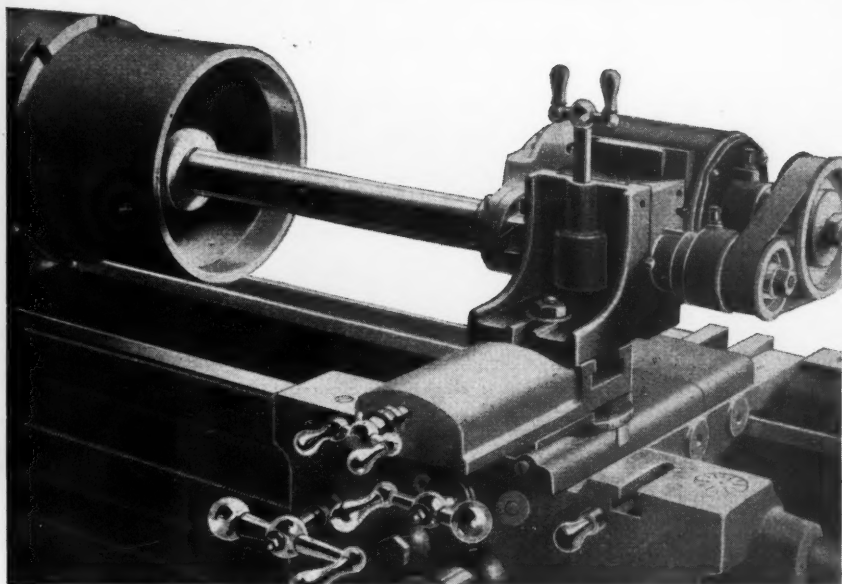
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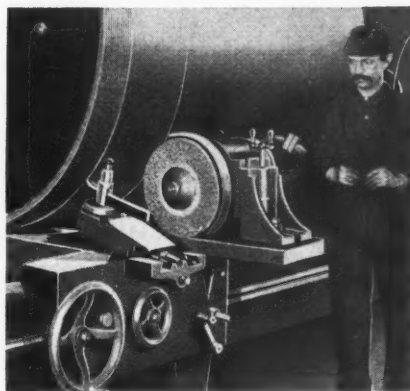
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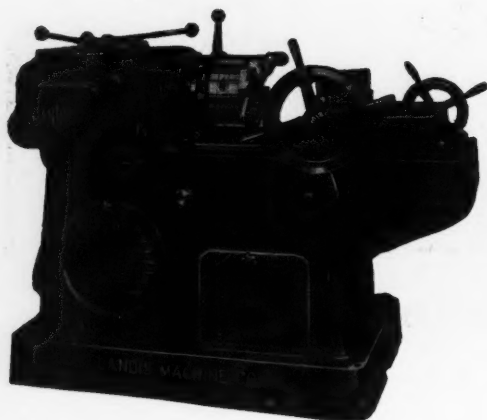
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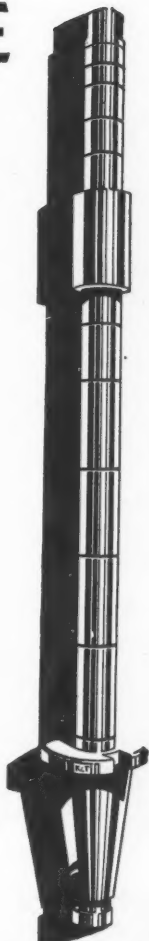
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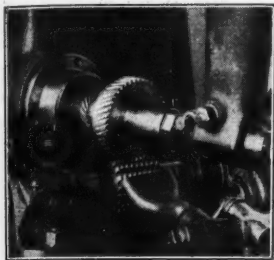
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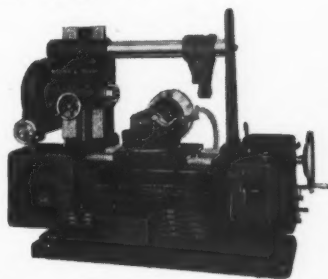
THE rugged, accurate construction of the Brown & Sharpe No. 44 Gear Hobbing Machine assures the production of quiet, smooth-running gears for use in quality products.

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The No. 44 will hob both spur and spiral gears to 20" diameter, 10" face; diametral pitch, cast iron 3, steel 4. If you use spur or spiral gears it will be to your advantage to inquire further into the possibilities of the No. 44.



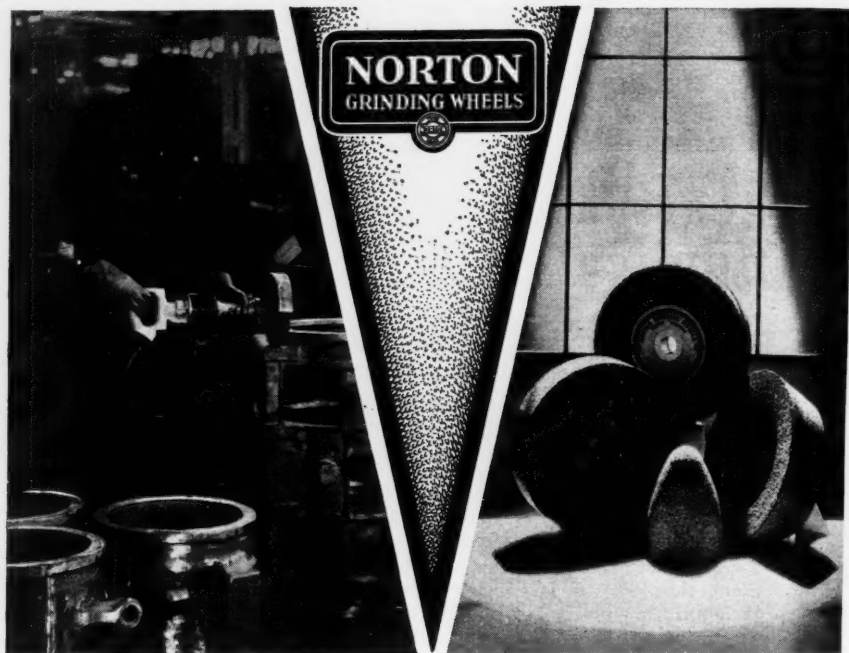
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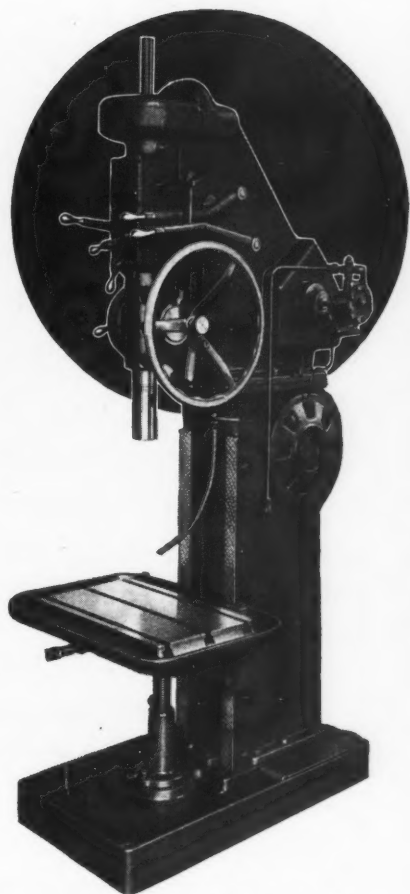
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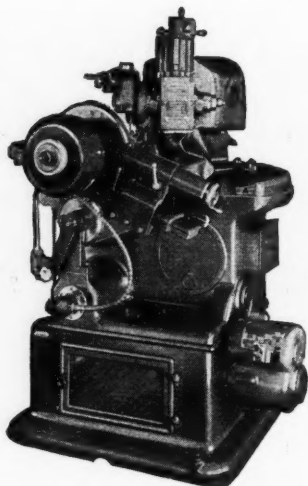
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MODERN Machine Shop

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A Magazine for Machine Shop Executives

HOWARD CAMPBELL, Editor

Vol. 3

MARCH, 1931

No. 10

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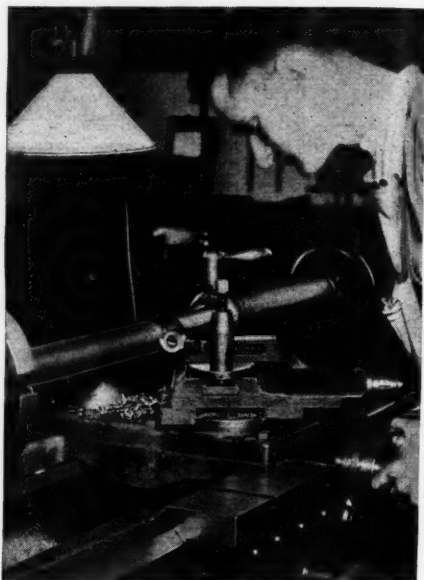


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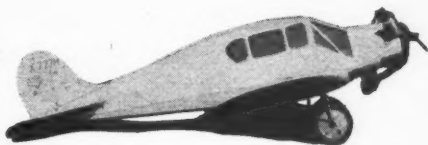
MARCH, 1931

CINCINNATI, OHIO

VOL. 3, No. 10

The Manufacture of the Eaglerock Plane

*Wherein the author describes
a number of interesting op-
erations and tools.*



By JOS. C. COYLE

MOST airplane manufacturers carry on a considerable amount of experimental work continuously, looking toward the betterment of the product and methods of construction. In the Alexander Eaglerock factory, at Colorado Springs, Colorado, as in other similar plants, much of this develop-

ment work must first be done by hand, or by the use of special attachments on standard machines. One of the most useful machines in the plant, both for production and for experimental work, is the Campbell nibbling machine shown in Fig. 1. Any shape or design of sheet metal part can quickly be laid out from the drawing and cut to the shape and size desired with this machine. When the design of a sheet metal part has been adopted and standardized, a templet is made from which to lay out parts for production and the templets are also cut to shape in this machine.

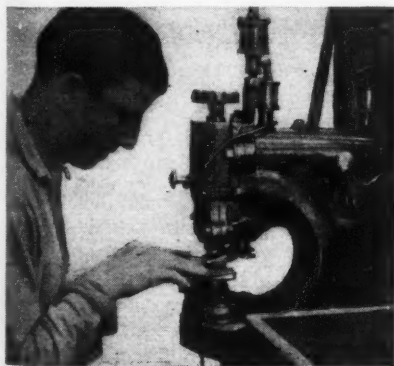


Fig. 1—Using the Campbell Nibbling Machine to shape a templet.

The fuselage of the Eaglerock plane is made almost entirely of Shelby seamless steel tubing, fused together at the joints with an acetylene torch. Purox No. 00 tips are used on the torches, due to the comparative thinness of the tubing walls. The first operation in the preparation of the tubing is that of cutting it to the proper lengths, which is done with the

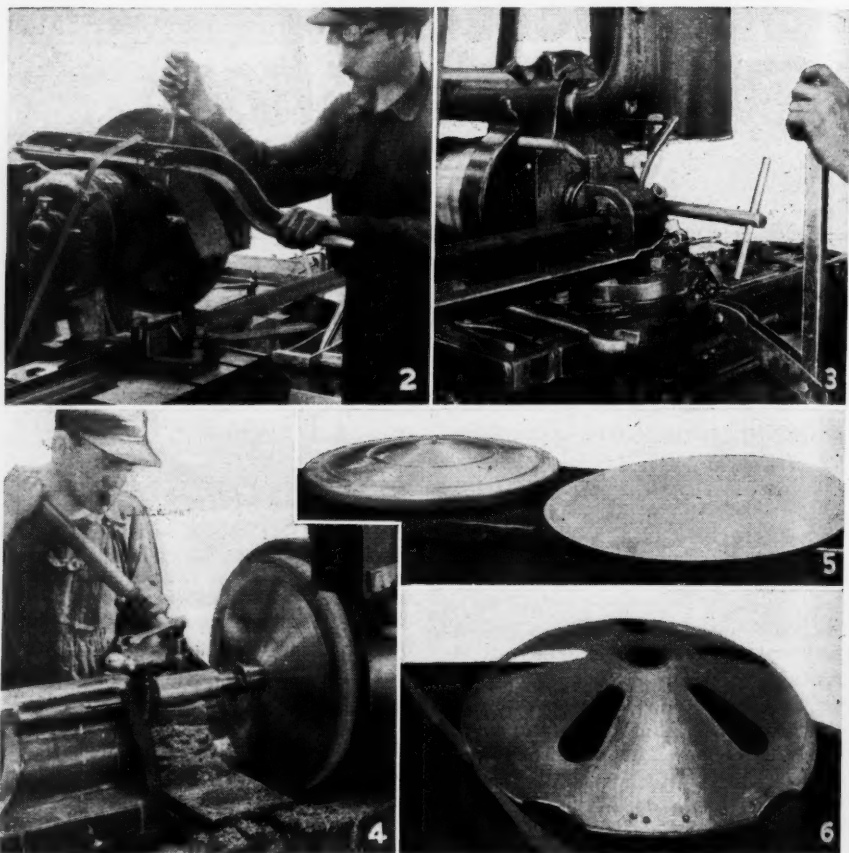


Fig. 2—All tubing for the fuselage is cut to length in this cold saw. Fig. 3—The ends of the tubing are cut to the correct angles by sawing in this milling machine. Fig. 4—Spinning a wheel faring to shape. All farings and nose cowlings are shaped by the spinning process. Fig. 5—At the right is a blank of sheet aluminum to be made into a wheel faring, and at the left is the wood form upon which the piece is to be spun to shape. Fig. 6—Here is a nose cowling that has been shaped by the spinning process described above.

aid of a cold saw, as shown in Fig. 2. Tubing ranging in size from 0.035 in. wall thickness to $\frac{1}{4}$ in. wall is cut with this saw, which runs at a speed of 3,600 r. p. m. In line with the effort to minimize the fire hazard as far as possible, a sheet metal chute with a downward curve has been attached to the back of the saw so as to direct the

stream of sparks into a metal can.

In order to obtain perfect joints where the ends of the tubing are welded together, the ends are sawed to the required angles by the use of the equipment shown in Fig. 3. The machine is a LeBlond miller, to the table of which a chuck has been bolted, as shown, to hold the tubing. The chuck

can be swung to any desired angle, as required. In order to speed up the operation, the crossfeed was removed from the table and a lever, shown grasped in the operator's hand in the illustration, was substituted. With this lever the operator can feed the work to the saw as fast as the saw will cut it.

Wheel farings and nose cowlings, which are made from 24-oz. sheet aluminum, are given the necessary shape and form by spinning. A wood or metal form of the shape desired is

bolted to the faceplate of an engine lathe, then a circular blank is placed over the form, power is applied to rotate the faceplate at a high rate of speed, and the blank is spun to shape by means of a greased stick that is held in the operator's hands. Pressure is applied by resting the stick against the toolrest so as to obtain the necessary leverage. An operator is shown in Fig. 4 spinning a wheel faring, and Fig. 5 shows both a blank and the form upon which it is to be spun. Fig. 6 shows a nose cowling

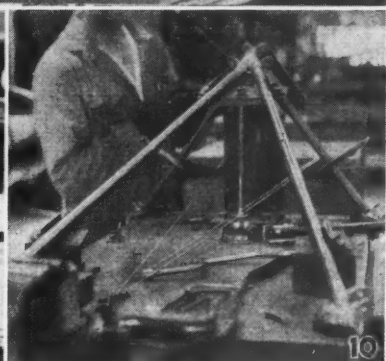
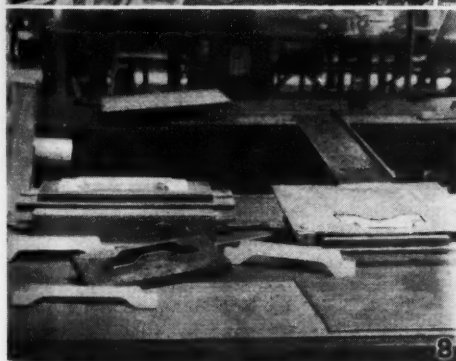
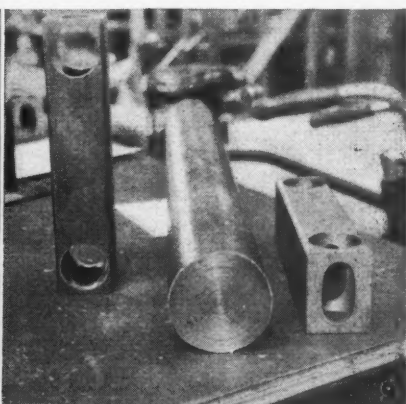
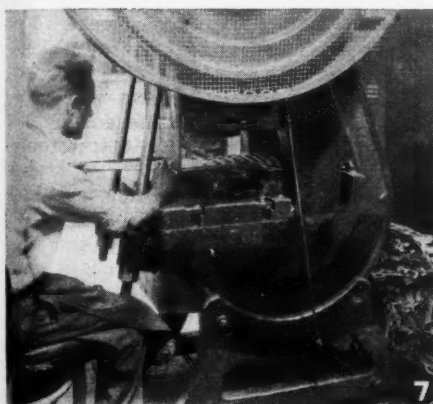


Fig. 7—Blanking out plywood gussets on a punch press. Fig. 8—Tools used to cut the gussets. Fig. 9—The raw stock is shown in the center, with a finished piece at the right. The production of an oval hole through the axis of the bar is an interesting operation. Fig. 10—Welding quadrupod braces for the landing gear. Jigs are used for all welding operations.

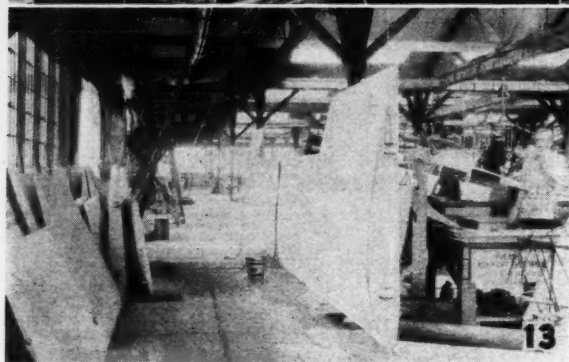
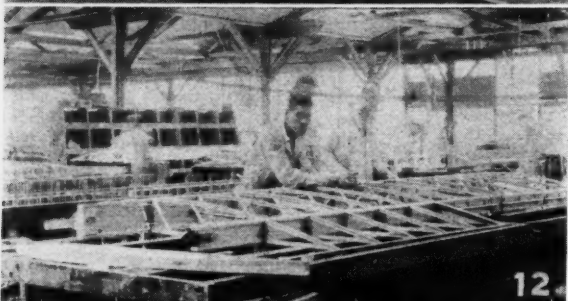
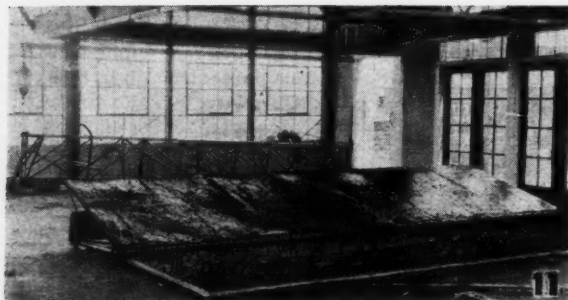


Fig. 11—The complete fuselage is dipped into this tank of Lionoil. Fig. 12—The ribs and spars are held in jigs for assembling, thus insuring that each part is assembled in the correct position. Here is a wing partly completed. Fig. 13—The wings are suspended from an overhead track for transporting to the "dope" and painting departments.

for a Kinner motor, which has been formed by spinning as described above.

In Fig. 7 an operator is shown performing an interesting operation—blanking out plywood gussets on a

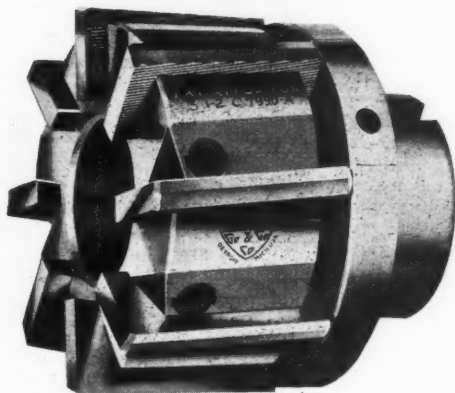
strip of Haskelite, ready for another cut.

The construction of the Eaglerock "Bullet" plane involves the use of an external sleeve for the landing gear

punch press. The tiny rib gussets used in the Eaglerock plane are of Haskelite plywood. As the entire rib, although tested to withstand a pressure of 480 pounds, weighs only 6½ oz. and contains 22 separate wood parts, some idea of the size of the gusset may be had. These gussets were formerly cut by the use of a table saw in the woodworking department, by nailing several thicknesses of the plywood together and sawing through the entire lot. By the use of the tools shown in Fig. 8, these gussets are produced in considerably less time than formerly and are perfect as to size and shape. The hollow knife used in this operation is shown in the foreground of the illustration, a knife mounted in a shoe is shown just back of it, and at the right is the stripper plate. The stripper plate is made of ¼-in. spring steel, with an inch-square block of rubber under each corner. As the gusset is cut and forced through the hollow knife, and the ram starts upward again, the stripper plate automatically releases the

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which is of steel, 7 in. long, with an oval hole $\frac{3}{4}$ x $1\frac{1}{8}$ in. through it lengthwise and with two $1\frac{1}{8}$ -in. round

holes through the ends. A number of different methods were tried in an effort to find a precise and economical method of machining the oval hole before the following method was adopted. A $1\frac{1}{8}$ -in. hole is drilled through a 7-in. length of $2\frac{1}{8}$ -in. round steel. This piece is then heated and flattened at one stroke of a punch press, producing a hole of the desired shape and dimensions. The piece is then milled to shape and the cross holes are drilled. When finished, the piece is $1\frac{1}{2}$ x 2 x 7 in. long.

Special jigs are used for welding the sections of tubing, so that the dimensions and angles will be exact and also to relieve the operator of the necessity of holding the pieces while welding them. The jig shown in Fig. 10 holds the quadrupod braces in position while the joints are welded, as shown. Box jigs of angle iron are used to hold the fuselage sections in proper relation to each other while they are being joined, and the motor mounting, which is also of tubing, is completed as a separate unit in a jig of its own. When completed, the fuse-

lage, motor frames, and other parts are picked up by an air lift on an overhead monorail track and are conveyed to another department where they are dipped into the vat of Lionoil shown in Fig. 11. After dipping, they are left hanging long enough to dry, then they are conveyed back to the assembly department on the same track.

The wings of the Eaglerock plane are of spruce and plywood, covered with mercerized cotton and sprayed with three coats of nitro-cellulose lacquer and five coats of a mixture of nitro-cellulose

and aluminum. For assembling, the ribs, spars, and false nose of the wings are joined together in jigs which hold each part in its proper place with relation to the others, the ribs being lined up in the jig first and the spruce bars slipped through. Five spad trusses are used in the upper wing and center section. A wing is shown in the assembly jig in Fig. 12. After the wings have been covered, they are hung on an overhead track as shown in Fig. 13 and transported to the doping department, where they are painted with three coats of a solution that draws the fabric taut, reinforces it without adding perceptible weight, and makes it impervious to moisture. After doping, the wings are painted, first with aluminum paint, and then with the color specified. When dry, they are transported to the final assembly department, Fig. 14, where they are assembled to the planes. From the rigging line the ships are towed by tractors to the proving grounds adjacent to the plant where they are thoroughly tested before delivery to the customers.

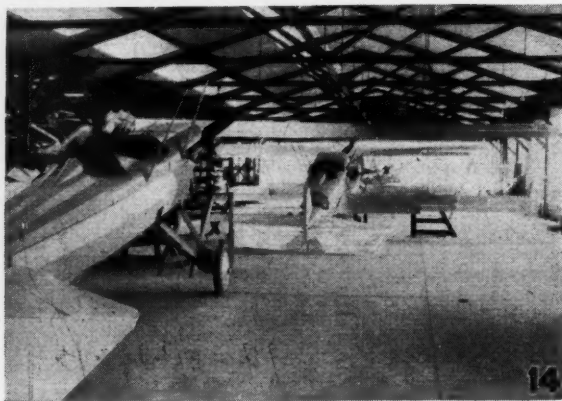
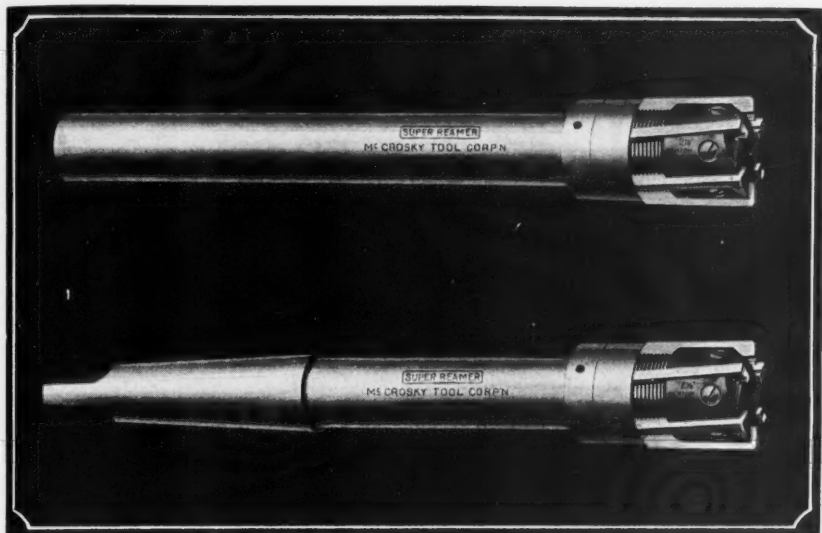


Fig. 14—One side of the final assembly department.



McCrosky-SUPER Machine Reamers Cut Hole Costs

FIRST, by reaming true and uniform holes. They hold their size because the blades are locked in the body by a patented lock that works with the force of the cutting thrust. They cut the cost of each hole because every set of McCrosky-SUPER blades has an adjustment range large enough to do the work of ten or more solid reamers. The reamer body is hardened. New sets of blades can be inserted in the original again and again.

Bulletin No. 12-A shows all styles of standard McCrosky-SUPER Reamers and examples of special reamers and line bars made by McCrosky. Send for a copy.

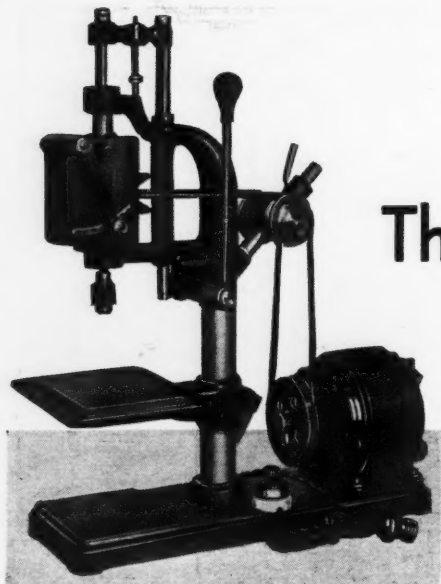
These features are incorporated in nine other styles of standard McCrosky-SUPER Reamers that produce uniform holes with economy.

McCROSKY TOOL CORPORATION

MEADVILLE, PA.

Branches in Cleveland, Detroit, Chicago, Toronto





The New VICTOR Super- Drill

is cutting drilling costs everywhere!

IN ALL SHOPS . . . from the largest industrial plant to the small job shop . . . the new VICTOR Super-Drill is cutting costs 50 per cent and more.

Why? Because the five spindle speeds of this machine allows it to be used on practically any drilling job in the shop.

And, the New "Wonder Pulley" enables your operator to change the spindle speed instantly **WITHOUT STOPPING THE MACHINE OR TOUCHING A BELT.**

Besides this feature, an adjustable spring locking device automatically regulates the belt tension, ball bearings at points of wear assure long life of the tool, and all parts are made to close accuracy tolerances, of substantial weight and durable.

The New Wonder Pulley



The speed lever causes the two parts of this patented conical pulley to close together or separate, thus regulating the speed of the spindle.

Write for a Bulletin!

U. S. Automatic Box Mach'ry Co.

NEWTONVILLE, BOSTON, MASS.

How would You mill this Groove

In actual production Scintilla Magneto Company found that a standard Gorton Pantograph Profiler did the job more profitably than any special machine which they could have designed themselves . . .



Name of part: Magneto Cover.
Operation: Milling Felt groove.
Material: Aluminum (Permanent mould casting).
Stock removed: $5/64$ " square groove
4" long.
Cutter: Special $5/64$ " dia. single lip.
Cutter R.P.M.: 9000.
Finish: Smooth and clean—no burrs.
Limits: All dimensions plus or minus .001".
Production per hour: 40 pieces.
Machine: Standard GORTON 3-X with simple work-holding fixture and steel master template.



A steel template guides the pantograph reducing mechanism which controls the cutter path. This template is four times oversize and reduces any error by this proportion.

This aluminum magneto cover requires machining the $5/64$ " square groove indicated above. The groove must be located accurately and held to close dimensions.

How would YOU do this job?

Scintilla found the Gorton way most effective. With a simple work-holder and a steel master template (both made in a few hours) they were able to put the job on a standard Gorton Profiler and get production at the rate of 40 per hour. An excellent example of the possibilities of pantograph profiling.

Scintilla machines several other types and sizes of magneto covers on this same profiler. Setup for each job takes only a few minutes. Unskilled operators can handle after job is set up.

Perhaps one of your jobs belongs on a Gorton Profiler. To find out, send us blue prints or samples. If your job belongs on a Gorton Profiler, our engineers will submit a layout and schedule of operating methods and advantages.

George Gorton Machine Co.
1101 13th St., Racine, Wis.



GORTON

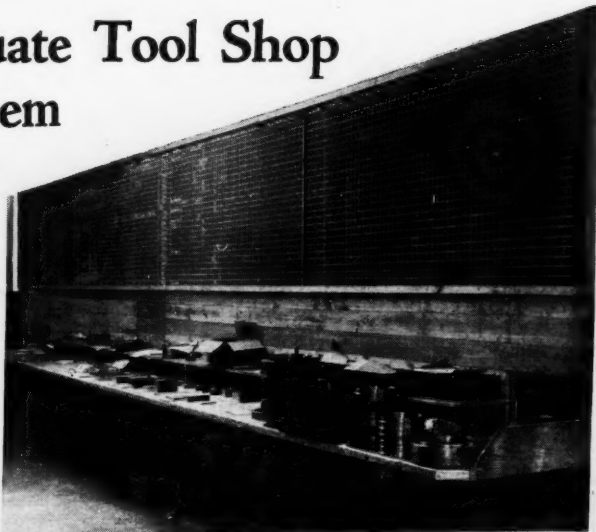
High-Speed PROFILERS

An Adequate Tool Shop System

Here is a job or tool shop system that is simple, yet elaborate enough to provide all the information necessary for cost accounting and production records.

By FRANK W. HACK

President, Cramp Manufacturing Corporation, Chicago, and Vice President American Machine & Tool Institute.



THE cost and production system outlined in this article, if adopted in an average job shop, will provide adequate and accurate records of work in process, costs, and such other information as will help one to intelligently conduct his business. It is strictly a job shop system, and is sufficiently flexible to meet the requirements of the accounting department, whether involving an order for a complete machine, a single tool, or large lot production runs of thousands of parts. The system was conceived to eliminate losses resulting from oversight or failure to properly charge material and labor items, and is simple enough to function properly and without undue expense in the small shop. This system was evolved by the writer after much experience with other job shop systems, the best features of all of them being selected in the process. Most systems were too complicated and failed to provide the necessary information without undue clerical work, delay, and expense.

The majority of the orders received

for tool, die, or special machine work are given to the sales representative verbally, although formal orders—which more or less vaguely confirm the verbal instructions—are usually sent in afterward. When a prospective customer opens negotiations for the purchase of equipment, a sales engineer is sent to his plant to find out exactly what is wanted and to give the customer all possible assistance concerning design, and so on. The engineer will probably come back with a number of sketches and data. From this information the estimating department makes up a preliminary drawing and an estimate sheet, Fig. 1, on which the various details that enter into the cost are outlined. The estimate sheet is filed and the sales engineer goes back to the customer with the preliminary drawing and estimated price.

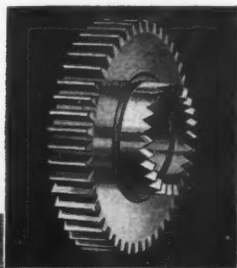
As soon as the order is received, the sales representative returns the drawing to the engineering department, which proceeds to make working drawings including thereon whatever

The full
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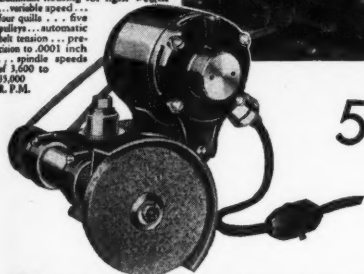
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less than a minute per Operation . . .



The Dumore Grinder No. 5 has a full ½ h. p. Dumore Motor of the universal type . . . automatic cooling system . . . fan which keeps the motor "cool" under all conditions . . . aluminum housing for light weight . . . variable speed . . . four quills . . . five pulleys . . . automatic belt tension . . . precision to .0001 inch . . . spindle speeds of 1,600 to 11,000 R. P.M.



5 accurate grinding operations per piece in 4½ minutes . . . by Durant Manufacturing Co.

WHEN speed without loss of accuracy is needed Dumore Grinders are more than equal to the situation. Durant Mfg. Company, Milwaukee, makers of Productimeter counting machines, had a rush order for special, high speed counters in which the driving gears, of high grade tool steel, each required five grinding operations, three external and two internal. Specifications required outside face ground to overall length of .468 inch, with no tolerance above and .001 minus; inside face ground to a width of .250 inch, plus or minus .001 inch; outside diameter of hub ground to .625 inch, tolerance of .001 minus. These five operations on each piece were accomplished in 4½ minutes by means of two No. 5 Dumore Grinders; one grinder set up for the external and the other grinder set up for the internal grinding. Fast and accurate performance is usual with Dumore Grinders.

THE DUMORE COMPANY, 28 Sixteenth St., Racine, Wisconsin

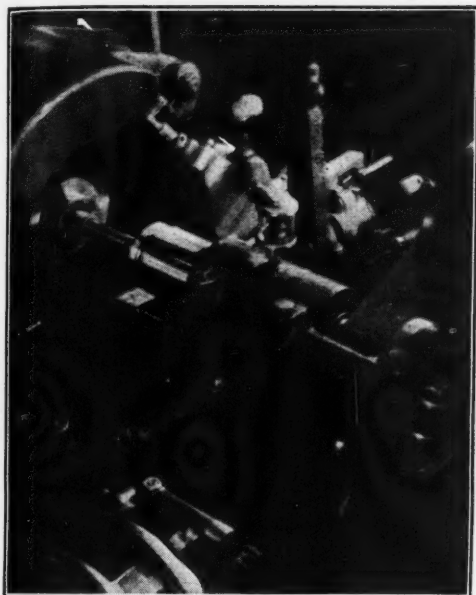


THE DUMORE COMPANY
28 Sixteenth St., Racine, Wis.

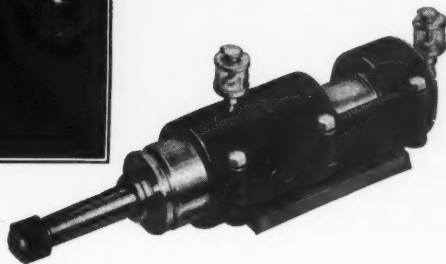
Please send facts on No. 5
Grinder together with free
copy of "Precision Grinding"

Name.....
Address.....
City.....
State.....

TRADE MARK
DUMORE HIGH-SPEED GRINDERS
REG. U. S. PAT. OFFICE



Ex-Cell-O Spindles are adaptable, by means of various brackets, to all makes of internal grinding machines, and to external and surface grinding as well. Each spindle is designed and built to meet specific grinding requirements.



INTERNAL GRINDING SPINDLES

Achieve a High Degree of Accuracy With Maximum Speed and Efficiency

TO combine maximum speed with a rigidity which would permit a degree of accuracy hitherto unknown in production grinding—this is the specific task for which the Ex-Cell-O spindle was designed, and which it is doing successfully every day. This success is made possible by the precision with which each part is produced; and by the Ex-Cell-O high speed ball bearings with which it is fitted—bearings designed and manufactured by Ex-Cell-O exclusively for grinding spindle service. Catalog upon request.

Other Ex-Cell-O Products

Ex-Cell-O also produces drill jig bushings, aircraft engine parts, multiple spindle heads, Diesel fuel pump parts, automatic machine work, ground thread taps, milling cutters, gear shaper cutters, diamond boring machines, counterbores, special machines and tool details.

EX-CELL-O

AIRCRAFT & TOOL CORPORATION

NEW YORK • CHICAGO • BUFFALO • CLEVELAND • DAYTON



| ADVANCE ORDER RECORD | |
|---|----------------------------|
| Date <u>1-1-30</u> | Shop Order No. <u>1450</u> |
| Customer <u>Williams & Johnson</u> | Customer's Order No. _____ |
| Dept. No. or Indiv. Name _____ | Invoice No. _____ |
| Address <u>1448 W. State St., Chicago</u> | Shipping Ticket No. _____ |
| Descriptions of items _____ | Work Ticket No. _____ |
| _____ | Let No. _____ |
| _____ | Operation No. _____ |
| Drg. No. <u>D-86003</u> | Tool No. <u>Same</u> |
| _____ | Part No. _____ |
| Order to <u>Make (1000) Complete Mounting Posts as per Drg. #86003</u> | |
| _____ | |
| Tools needed _____ | |
| Conditions of order—Price per hr. <u>\$ 1.85</u> Price quoted <u>\$ T & M</u> | |
| Material _____ | Tools furnished by _____ |
| Furnished by _____ | _____ |
| Delivery to be as follows _____ | _____ |
| Balance _____ | _____ |
| Miscellaneous Information <u>See Packing Inst. below</u> | |
| MEMO NOT TO BE RECORDED | |
| <u>Cover posts with oil and peak with paper. Use std. shipping cases (must not weigh over 50 lbs. each when packed)</u> | |
| _____ | |
| _____ | |
| FROM ESTIMATE | |
| Class of Billing Recommended, <u>_____</u> | Total tools _____ |
| Total hours <u>144</u> at <u>\$ 1.85</u> per hr. | _____ |
| Estimated by <u>T & M</u> | Safety Factor _____ |
| Date _____ | Material _____ |
| Price per hour quoted _____ | Total _____ |
| Price quoted _____ | % Profit _____ |
| Tool price quoted _____ | Total Est. _____ |
| _____ | Shop Order No. <u>1450</u> |

Fig. 2—Original Order Record, Advance Order Record, and Drafting Order Record. Size, 6½ x 11 in.

"Original Order Record" and is pink in color, goes to the accounting department. The duplicate, which is blue, is titled "Advance Order Record" and is sent to the shop with the estimate, drawings, and recommendations to hasten the ordering of materials. The triplicate, which is yellow and is titled "Drafting Order Record," gives the drafting department authority to make whatever working drawings may be necessary and is then filed in the engineering department as a permanent record. The three copies bear the same number in the upper right hand corner, which automatically establishes the shop or job order number. The form that is used for these

three copies is shown as Figure 2.

When the customer's formal order is received in the mail, an "Order Record Rider" is issued in duplicate by the chief engineer, one copy going to the shop and the other to the accounting department. This rider is practically the same as the three copies referred to above, with the exception of the title and color, which is green. This rider carries the customer's order number and calls attention of all concerned of any change in price or conditions of the order not shown on the advance order record sheets.

The shop routine starts with the superintendent's clerk, who places the assembly drawing and estimate sheet before the superintendent and then cuts up the detail drawings, separating the parts and attaching a job ticket to each detail print. The job ticket, Fig. 3, is on heavy yellow paper, cross-sectioned on the reverse side to accommodate any extra sketch-

| PCS NEEDED | AT ONCE | RUSH | REGULAR | DEPT. |
|--|-----------------------------|-------------------------|--------------------------|----------------------------|
| DATE <u>1-1-30</u> JOB TICKET NO. <u>1450</u> | | | | |
| PART NO. <u>746</u> | QUANTITY <u>25</u> | STARTED BY <u>_____</u> | FINISHED BY <u>_____</u> | W.C. BUMP DRAFTSMAN |
| PART NAME <u>Bull Gear Rub as per sketch on</u> | | | | DRAWING NO. <u>746-13</u> |
| TOYOTA side | | | | SHOP ORDER NO. <u>1450</u> |
| REMARKS <u>Carbonize, bore hole to size and harden</u> | | | | PROMISED <u>1/15/30</u> |
| FOR <u>Williams & Johnson</u> | | | | |
| ADDRESS <u>1448 W. State St., Chicago</u> | | | | |
| PERFORM THE FOLLOWING OPERATIONS | | | | |
| OPERATION NO. | | | | TIME ALLOWED |
| 1 | Face, Turn Hub, Bore & Bore | | | 1 1/2 |
| 2 | Finish other side | | | 1 1/2 |
| 3 | Cut Keyway | | | 1/2 |
| 4 | Carbonize | | | 1/2 |
| 5 | Bore to size | | | 1/2 |
| 6 | Harden | | | 1/2 |
| 7 | Trough Hole | | | 1/2 |
| PLACED IN STOCK BY <u>J.H.C.</u> DATE <u>1/8/30</u> | | | | |
| ON HAND | 75 | PCS. RECEIVED | 25 | TOTAL 100 |
| RAW MATERIAL RECORD and COST SUMMARY | | | | |
| ORDERED FROM <u>Jackson Steel Co.</u> | | | | |
| DATE <u>11/1/30</u> | PRICE PAID | 10 1/2 | HOURS | 80 |
| PUR. ORD. NO. <u>2881</u> | WEIGHT | 450 | LABOR | 1 1/2 |
| NO. OF PIECES <u>27</u> | PART COST | 75 00 | TOTAL | 81 1/2 |
| KIND OF MAT. <u>Disc, Forgings</u> | LABOR COST | 34 1/2 | FINISH | 1 1/2 |
| SIZE OF MAT. <u>1/2" X 1 1/2" X 3/4"</u> | | | | |

Fig. 3—Job Ticket. Heavy yellow paper, size 7¼ x 9 in. The back is cross-sectioned for sketching.

SAFE · VALVE · COUPLINGS

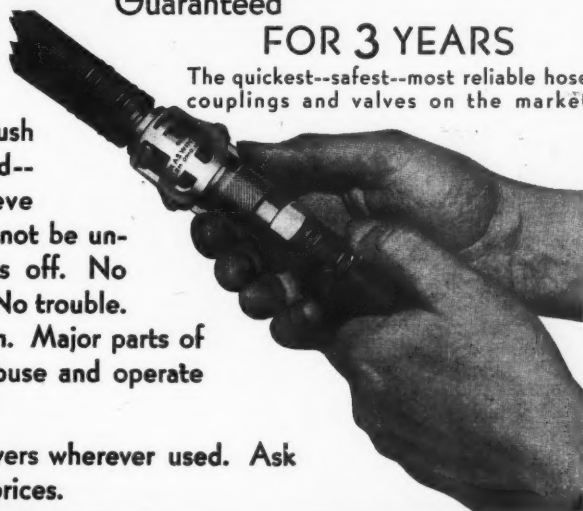
Quick As Wink

Positive control of the air anywhere between the compressor and tool. Push valve sleeve forward--air is on. Pull sleeve back--air is off. Cannot be uncoupled unless air is off. No leaks. No sticking. No trouble. All steel construction. Major parts of "Stainless." Stand abuse and operate under all conditions.

Time and Money savers wherever used. Ask for information and prices.

Guaranteed
FOR 3 YEARS

The quickest--safest--most reliable hose couplings and valves on the market



FOR
HIGH SPEED
LOW COST
POLISHING

No method compares with Quick As Wink Cushion Abrasive Wheels. Let us tell you how it is done.



C. B. HUNT & SON
SALEM, OHIO

| CRAMP MANUFACTURING CORPORATION | | | |
|---|------|------|---------------------------------|
| BILL OF MATERIAL AND STOCK REQUISITION | | | No. 2450 |
| SHOP ORDER NO. 1450 | | | DATE 1-2-30 |
| P.A. No. | Qty. | Unit | DESCRIPTION |
| | | | (PRINT DIRECT TO COPY SHEET) |
| 1 | 1 | | C.I. Base as per pattern |
| 2 | 1 | | 5/8 x 2 x 8 1/2 C.R.S. |
| 3 | 1 | | 1/2 x 1 1/2 x 2 1/2 |
| 2600 | 1 | | 1/89 1/2 x 2 1/2 type S Arm Bar |
| 11 | 7 | | 1/58 1/8 x 2 1/2 |
| 11 | 6 | | 1/35 1/5 x 2 1/2 |
| 7 | 1 | | 1/2 x 1 1/2 x 2 1/2 |
| 8 | 4 | | 1/2 x 2 x 1" Dowels |
| 9 | 7 | | 5/16 x 3/8 F.R. Nut Screws |
| 10 | 1 | | 2 1/2 x 3/8 "Thumb Screws |
| DIRECT MATERIAL ON ORDER: PATTERNS, BLUE SHOTS, SAW DUST, ETC. | | | |
| P.A. No. | Qty. | Unit | DESCRIPTION |
| 2577 | 1275 | 1 | Pattern of C.I. Base |
| 2578 | 1328 | 1 | B.P. Paper (1) Tracing |
| FILLED: C.F.S. ISSUED: H.W.M. | | | |
| PURCHASING AGENT: THE FOLLOWING ITEMS REQUISITIONED ON THIS BILL ARE NOT IN STOCK. No. 2450 | | | |
| P.A. No. | Qty. | Unit | DESCRIPTION |
| 2508 | 1378 | 1 | Std. 3/8 Thumb Screws (Revised) |

Fig. 4—Bill of Material and Stock Requisition. Size, 6 x 11 1/2 in.

ing that may be necessary. He then writes up a resolution for material in quadruplicate, showing that material which is usually in stock, such as bar stock, screws, and so on, in the upper part of the sheet, shown as Fig. 4.

The original, which is white, immediately goes to the accounting department and is filed. The second and third copies, which are yellow and green, respectively, go to the stock clerk, who cuts and weighs the stock and records the weights on the yellow and green copies. The fourth copy,

which is blue, remains with the purchasing agent. Parts that must be purchased, such as patterns, castings, and so on, are listed in the space provided for that purpose and are promptly ordered from suppliers. As purchased material arrives, it is weighed and recorded on the green and yellow sheets as are the other materials.

When all the stock has arrived and the yellow and green stock room copies of the requisition have been

(Continued on page 30)

| No. 101 | | DATE 1-1-30 | |
|---------------------|--------|-------------|--------------|
| NAME James E. Mason | | | |
| JOB ORDER NO. | AMOUNT | RATE | ELAPSED TIME |
| 1275 | | STOP | 12 00 |
| | | START | 7 30 |
| 101.1 | | STOP | 2 00 |
| | | START | 12 00 |
| 1385 | | STOP | 2 30 |
| | | START | 2 00 |
| 678 | | STOP | 3 30 |
| | | START | 2 30 |
| 1173 | | STOP | 5 00 |
| | | START | 3 30 |
| | | STOP | |
| | | START | |
| | | STOP | |
| | | START | |
| | | STOP | |
| | | START | |
| | | STOP | |
| | | START | |
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| | | START | |

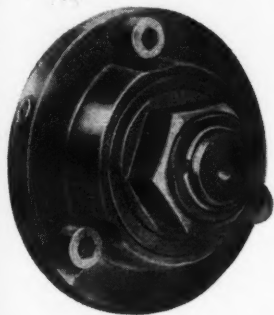
Fig. 5—Labor Cost Ticket. Size, 4 x 8 in.

Here's a Clamping Method That Saves You *Money!*

Swartz Standard Fixtures

... equipped with different sets of adapters for your various parts, gives you a combination locating, holding and clamping device all in one. Clamps, bolts, cams, screws, hinge plates, etc., are all eliminated.

Swartz Single Lever Movement forward and back, clamps and releases the part. Low initial cost, wide range of adjustability, usefulness and correct design means longer service and cheaper production costs.



Swartz Standard Fixture Locks

... can be placed on any fixture where you wish a fast and dependable means of clamping.


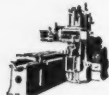

They are DIRECT DRIVE and designed to stand up under the most severe conditions where continuous, long and hard service is expected. *Swartz Fixture Locks can't wear out!*

Our engineers will be glad to show you how to use these locks on your work, and save money! Just send blue prints.

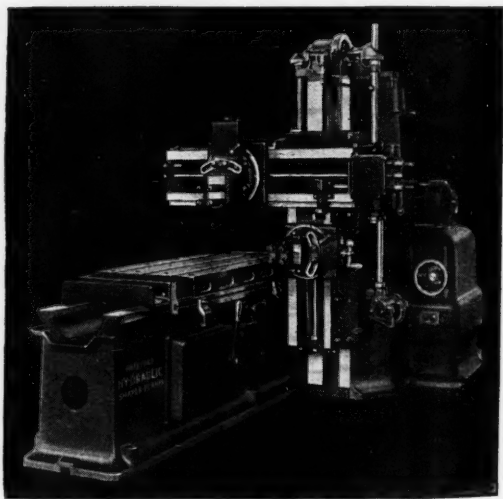
PRODUCTION MEN . . . will find many things of interest in the NEW Catalog No. 131-B! Be sure you get your copy!

Manufactured and Sold by

GEO. A. GLOOR CO., Detroit, Mich.

A 7½ horse power motor  applied to a Rockford Hy-Draulic Shaper-Planer  will remove more metal per minute, per hour or per day than a 15 horse power motor  applied to a 36 inch crank shaper, all other operating factors being equal! Why?

The answer, in detail, will be sent promptly upon request to executives interested in making large savings on power and other operating expenses and increasing production on shaper-planer work.



ROCKFORD MACHINE TOOL CO.
2414 KISHWAUKEE STREET » « ROCKFORD, ILLINOIS

MOTOR DRIVE

SMOOTH OPERATION

FEED ROD

EASY PAYMENT

GEARED HEAD

5 POINTS
about the REGAL

Every Regal passes the LeBlond precision tests, and carries the LeBlond guarantee.

THESE five points alone bring a new value in the small lathe. Built by LeBlond, a leader and producer of fine machine tools for over 40 years.

It enables you to purchase a modern high-class tool at low cost and on easy terms.

The Regal will bring you precision, ease of operation, and unusual value per dollar expended.

It is equipped with an eight-speed selective geared headstock, normalized, heat-treated and hardened, sliding gears with final drive through helical gears; feed rod to take the wear off the lead screw,

\$398
F. O. B.
Factory

The Regal shown here is 10" (18" between centers). It sells for \$398.00, F. O. B. factory. Down payment is \$79.60. Balance in monthly installments of \$27.86.

self-contained motor with multiple V belt drive, all moving parts enclosed, heavy bed reinforced for rigidity and smoother operation. Built in sizes from 10" to 18". Prices range from \$398.00 to \$1,144.00. Comes to you complete (with motor), ready to run.

The R.K. LeBLOND Machine Tool Co.

CINCINNATI, OHIO, U.S.A.



THE R. K. LeBLOND MACHINE TOOL CO.
1202 Regal Division, Cincinnati, Ohio.

Send me full details of the Regal Line.

Name.....
Address.....
City.....State.....

An Adequate Tool Shop System

(Continued from page 26)

filled in, the yellow copy is forwarded to the accounting department for extensions and posting on the cost sheet, the green copy remaining as the stock keeper's record. It is here that the postings made from the first copy or

department as data for future reference. As each operation on the work is finished, the work is returned to the bench referred to above for the next operation, or to be assembled, inspected, and shipped. An advance shipping notice is made out by the shipping clerk and sent to the office

as shipments are anticipated, and a final shipping notice, Fig. 6, is sent as the shipments are made. This method of handling permits the prompt billing of items shipped.

Probably the most important part of the system is the cost sheet, Fig. 7. The cost sheet is first made up by copying all of the data from the original order record, which is the same as the advance order record shown in Fig. 2. The right-hand portion of

| FINAL SHIPPING NOTICE TO OFFICE | |
|--|----------------------------|
| Notify <u>Shipping Clerk</u> | Date <u>1-28-30</u> |
| (Part) (Whole) shipment ready to go to <u>William & Johnson Co.</u> | |
| Address <u>1442 Bate St.</u> | |
| Consisting of <u>1 Blank & Piece Die</u> | |
| <u>Truck</u> will deliver to <u>B. C. Co.</u> | |
| who will forward to <u>William & Johnson</u> | |
| Bill of Lading made out _____ by _____ | |
| Shipping Receipt made out <u>1-27-30</u> by <u>F. W. K.</u> | |
| | Shop Order No. <u>1450</u> |
| Customer's Inspector's Signature <u>J. C. Simons</u> | |

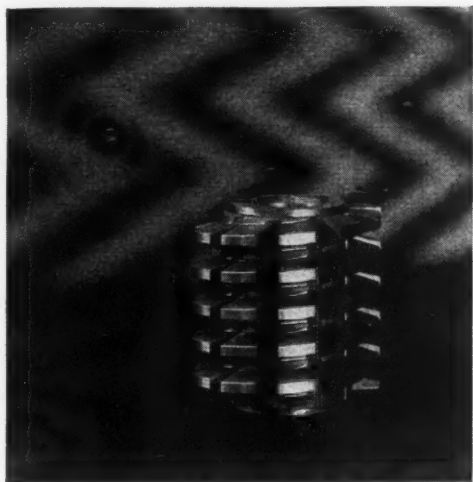
Fig. 6—Final Shipping Notice. Size, 4 x 6 in.

suppliers' invoices are checked against the yellow copy to insure against omissions. The material itself is placed on the work bench shown at the head of this article, together with the job ticket and blue print, and is classified according to the class or kind of operation required on it, such as bench, lathe work, shaper work, milling machine, and so on. The foreman then selects the jobs for the workmen in the order in which they are required.

The workmen punch in and out on the job time tickets, Fig. 5, at the start and finish of each job, copying the job ticket number on the job time ticket as they do so. The time tickets are sent to the accounting department daily so that the previous day's time can be entered on the cost sheets. When the work is completed, the job ticket is forwarded to the estimating

the cost sheet thus copied is typewritten, showing in detail the conditions of the order, and is made in triplicate. This combined cost sheet and original order record is filed in the cost ledger. The duplicate of the order record is mailed to the customer as a legal acknowledgment of his order, thus also giving the customer a copy of the instructions that appear on the shop order. The triplicate goes to the shop, where it is filed to replace the blue copy of the advance order record.

On the reverse side of the cost sheet are spaces for the entries of the raw material used on the job, giving the date, description, quantity, and cost of such material. These items are listed from the original copies of the material requisitions, Fig. 4, and are thus charged against the job to which they apply. The weights are entered from the yellow copies sent in by the stock



High production implies high perfection

High gear production under today's standards of accuracy implies perfection to a marked degree in the hob used in the generating process. Not claims for accuracy — not promises incapable of fulfillment—but the acid test of the lead check and the form check on standard hobs, and of the sample check on spline shaft and formed hobs, are today's surest safeguards of better gears . . . Only by such means can you be certain that your established standards of accuracy will be fully met.

Barber-Colman Hobs, used in Barber-Colman Hobbing Machines and sharpened on the Barber-Colman Hob Sharpening Machine will put into your plant's high production that high perfection which reduces rejects to the minimum and keeps your standards of quality at their highest attainable peak.

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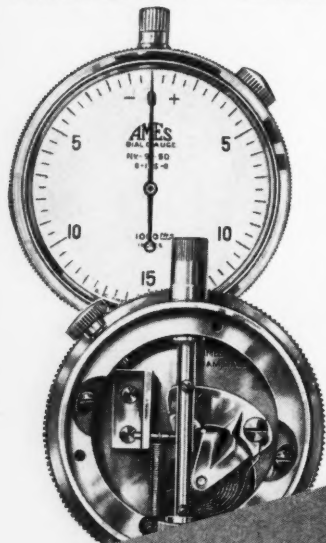
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Fig. 10
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Building the "Intertype"

Manufacturing Operations In the Production of the Modern Typesetting Machine

(Concluded)

By HOWARD CAMPBELL

THE operator shown in Fig. 10 is grinding the surfaces of the spacebands with which the spaces are provided between the words in a slug of type. The spacebands are punched from sheet steel and machined, then they are spring-tempered and hard-

11. The fixture holds the pieces at an angle so that they are finished to a thickness of 0.1015 in. at one end and 0.0115 in. at the other, all of which requires four operations—two roughing and two finishing. The roughing operation leaves 0.015 in. of stock to

be removed in the finishing operation.

Each spaceband carries a slide which is also punched from sheet steel stock, spring-tempered, hardened, and ground. The grinding operation is performed on the "Abrasive" surface grinder shown in Fig. 12, and the pieces are held by a special fixture on a Walker magnetic chuck, the magnets in the fixture be-

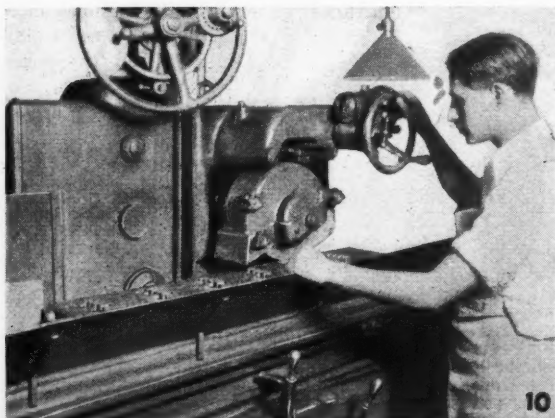
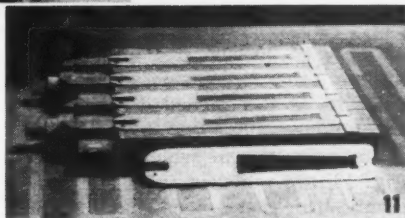


Fig. 10—Grinding spacebands on Norton Hydraulic Surface Grinder. The piece is tapered in two directions. Fig. 11—A section of the spaceband grinding fixture, with work in place. One of the pieces is shown resting against the fixture.



ened, after which they are ground to the correct thickness. The machine is a Norton Hydraulic Surface Grinder, equipped with a Walker magnetic chuck and a special fixture which holds 20 pieces. A section of the fixture, with one of the spacebands resting against it, is shown in Fig.

ing arranged so that the chuck holds both the work and the fixture. These slides are also held at an angle so that they are finished to a thickness

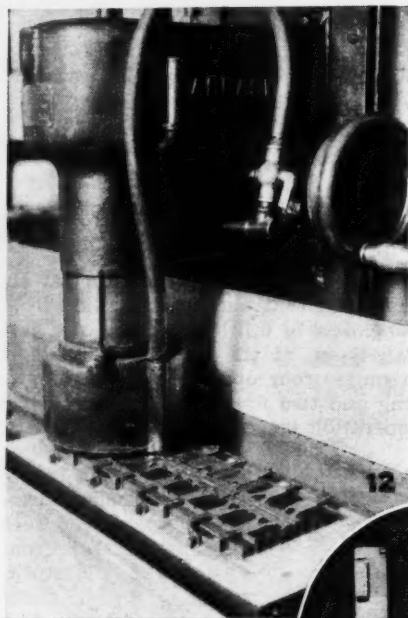


Fig. 12—Grinding slides for spacebands, using Abrasive Surface Grinder. Both work and fixture are held by the magnetic chuck. Fig. 13—A "matrix" of a capital letter "X."

Fig. 14—Rear of punch press showing conveyor leading from die. This conveyor keeps the pieces in proper order, the line of pieces being moved along in the trough by the action of the punch as each piece is stamped out.

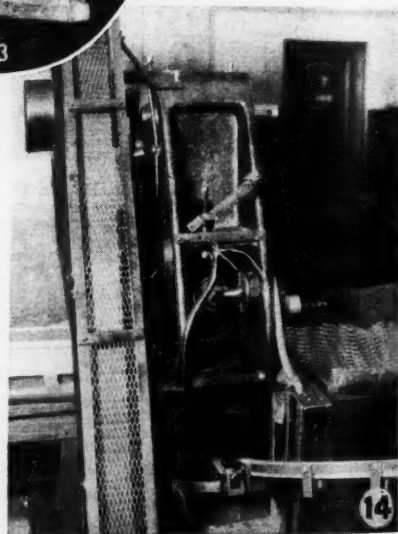
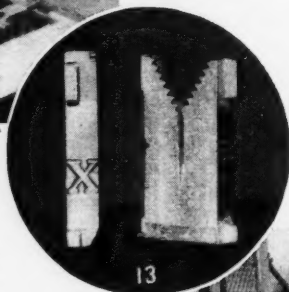
of 0.037 in. at one end and 0.005 in. at the other. A side clearance of 0.001 in. is also provided for, making a compound angle.

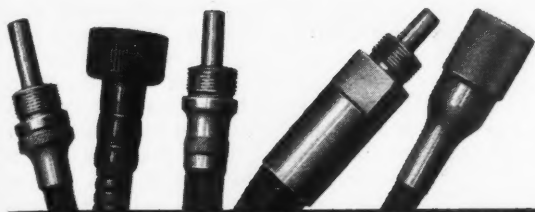
Matrices, one of which is shown in Fig. 13, are punched from strip brass of the thickness necessary for the size and type of the character it is intended to bear. As each piece passes through the die, it adds to a line of previously-punched pieces in a trough-conveyor which is shown leading from the rear of the press in Fig. 14. This

method of conveying the pieces from the press keeps them in alignment and order for the next operation. In subsequent press operations the several faces of the matrix are trimmed to provide a smooth, finished face and to reduce the piece to the correct dimensions.

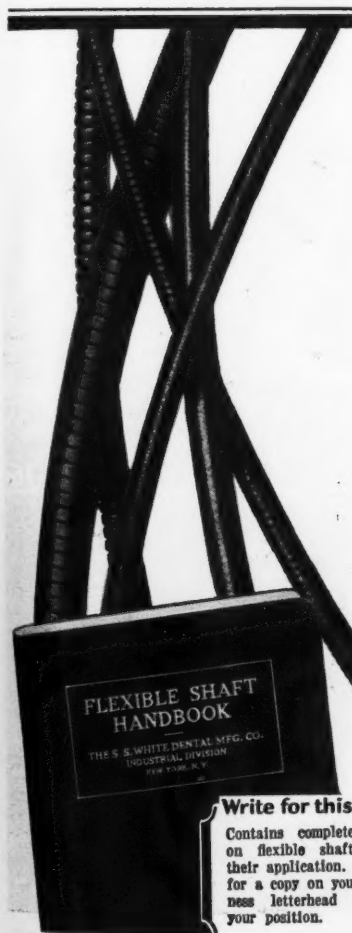
The impression of the character, or mold, is produced in the face of the matrix by a punch, operating in a small punch press in which the matrix is held by a fixture. Although the operation of stamping the character in the face of the matrix must needs be precise and accurate, the accuracy of the character is governed by the care and accuracy with which the character is engraved on the punch.

This operation is simplified and the possibility of error is minimized by the use of pantograph engraving machines, such as the one shown in use in Fig. 15. The punch





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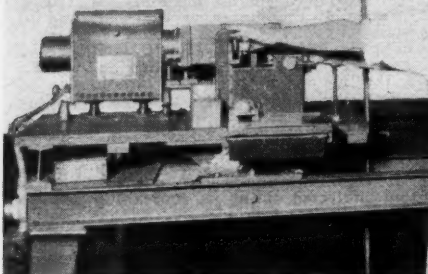
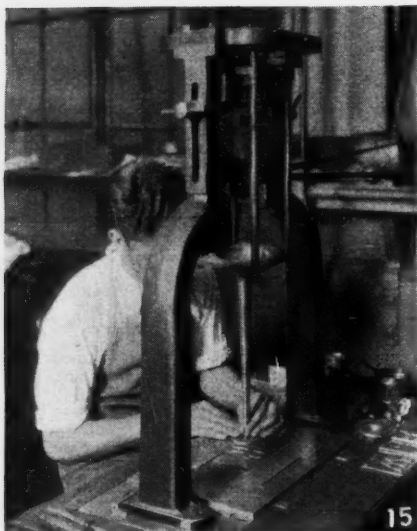


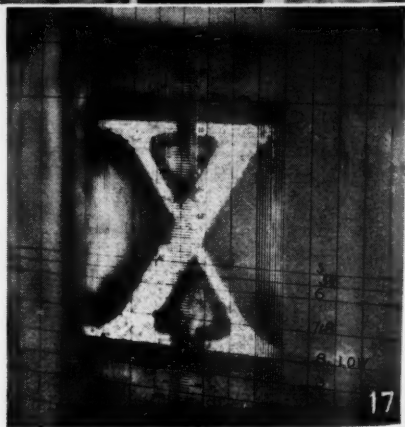
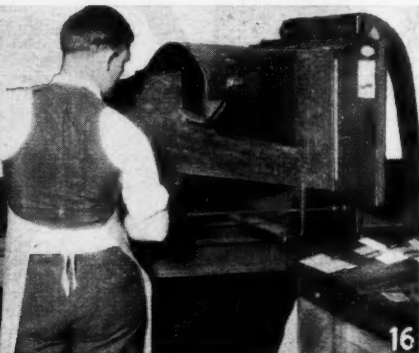
Fig. 15—Here a pantograph engraving machine is being used to machine a character on the end of a punch. Fig. 16—Examining a matrix for accuracy after the character has been stamped in it. The character is magnified $62\frac{1}{2}$ times and reflected on a screen inside the hood. Fig. 17—Reflected image of a capital letter "X." The character is $\frac{1}{8}$ in. high, the image is 8 in. high.

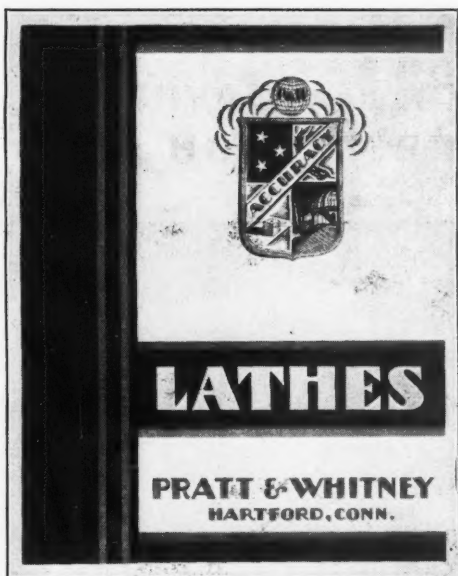
is held in a chuck at the top of the machine, and the stylus, at the lower end of the arm, is moved back and forth across the surface adjacent to the pattern, the tool at the upper end of the stylus removing all surplus stock and leaving the raised character on the punch. The pattern has also been made in a pantograph en-

graving machine of much larger size and made so that the stylus can follow the designer's layout. On an "8-point" letter, which is of a height that will permit nine lines of type to the inch, the reduction from the punch to the stylus, on the machine shown in the illustration, is 30 : 1. This reduction is, however, adjustable according to the size of the letter. All patterns are two inches high.

As the operation of stamping the characters in the faces of the matrices proceeds, each matrix is passed to an inspector who examines it to make sure that the character is properly located on the face of the mat-

(Continued on page 62)





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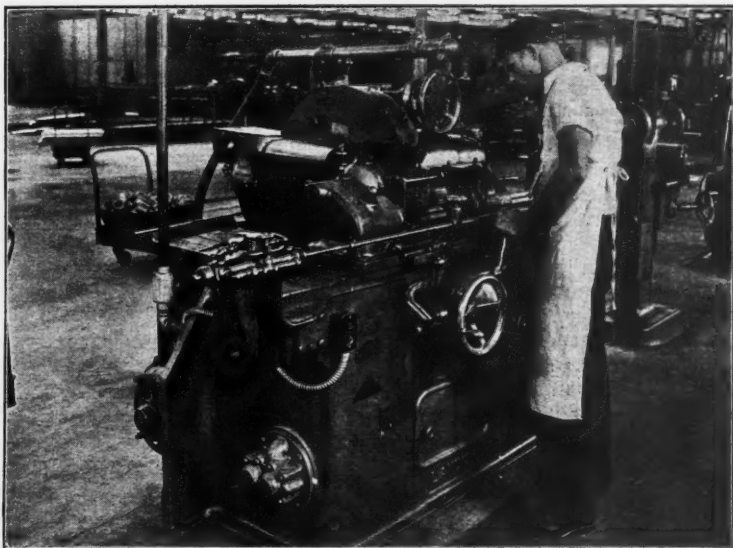
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Machinability of Metals

*By A. H. d'ARCAMBAL

Consulting Metallurgist, Pratt & Whitney Co., Hartford, Conn.

THE subject of the machinability of metals, which is a very important one, has received very little attention from investigators during the past few years.

President Boston, of the University of Michigan, has published two very interesting papers on the subject of machinability, but principally from the laboratory end. That is, he has measured the force required to remove a chip by a planer tool, the torque and thrust developed by a drill, as well as drill penetration under constant feeding load, energy required to remove a chip by a single tooth milling cutter, and so on.

Now, these are very interesting laboratory tests, but unfortunately one test will not always check the other in regard to the machinability of a certain steel. This afternoon we are going to cover this subject from a practical end; that is, give you the results of our experience covering several years in our plant, as well as in other plants located in that locality. The factors involving the machinability of materials are as follows:

- First, the machine tool used;
- Second, the cutting tool used;
- Third, the material machined;
- Fourth, the cutting fluid or coolant or lubricant, and

Lastly, the mental attitude of the machine operator.

Now, let's first consider the machine tool, or the machine used. During the past several years rapid strides have been made in improving the quality of machines, such as milling machines, screw machines, lathes,

planers, precision boring machines, and so forth. A revolution in the machine tool industry came in the early part of this century due to the introduction of high speed steel. Rapid improvements have been made since that time, and now with the introduction of tungsten carbide, certain types of machine tools are again being redesigned so as to accommodate these super-cutting metals.

Modern machine tools have the majority of parts made from heat-treated alloy steel, as compared with cast iron and machinery steel used a few years ago. Today we have heavier and more powerful machines, with larger motors, hydraulic feed, improved mechanical control, and so forth, and with these modern machines, cutting tools are required to do work they wouldn't have stood up under a few years ago.

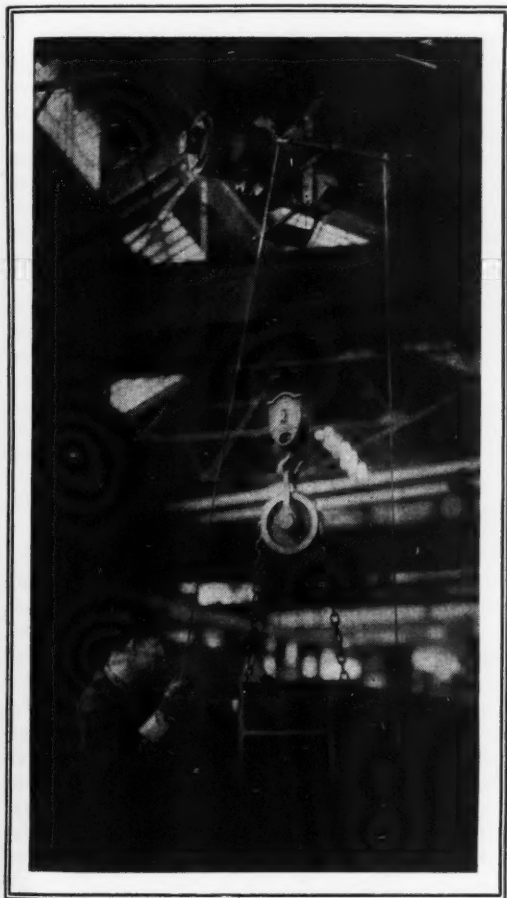
The second important factor is that of the metal-cutting tool used. The machine tool builders designate their product as "the master tools of industry." I do not believe it is going too far to call the cutting tools or the small tools "the indispensable tools of industry," for of what service is any machine tool if it is not equipped with the proper cutting tools? Of course, there have been rapid strides made in the small tools or metal-cutting tool designs. Practically all drills and cutters today are made of high-speed steel, as well as all lathe and turning tools, and many types of reamers, taps and so on. The demand for carbon steel tools of various types is rapidly diminishing.

There are three factors, of course,

* Paper read before Western Metal Congress at Civic Auditorium, San Francisco, Cal., February 19, 1931.

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that must be controlled if one is to turn out a good uniform metal-cutting tool; namely, the design of the tool, the steel used, and the hardening treatment. The majority of high speed steel tools today are made from the ordinary 18 per cent tungsten high speed steel. However, there is coming a greater demand for cobalt high speed steel, and we have found in our plant, as well as in many other plants visited during the past year, that economy is effected by making tools, such as lathe tools, planer tools, tool bits and so on, from this cobalt high speed steel. This cobalt steel costs from two to three times as much as regular high speed steel, but is certainly worth the difference in price, due to the better results and longer life obtained from this cobalt steel. We will bring that up a little bit later again.

The third factor is the material being machined. Now, the freest machining material we know of is ordinary Bessemer Screw Stock, known as S. A. E. No. 1112 steel. Recently, however, for some parts we were making in our screw machines, we could not secure a satisfactory finish even with Bessemer screw stock, so we used overdrawn screw stock, thus increasing the B Rockwell reading about 5 points.

The next type of tool is S. A. E. No. 1120, or open hearth screw stock. Then we come to a very interesting steel; namely, the high manganese steel being used, Hyten, Maxel, Jalcase and Hymo being representative types. We have found that these steels are cleaner, have better physical properties, and are much more readily machinable than the ordinary machinery steel known as S. A. E. No. 1020 and No. 1045. When we were using the No. 1020 and No. 1045 steels, we were constantly in trouble in machining the material. Usually

the steel was too soft, causing tearing. The operator usually believed the steel to be too hard, but when the material was Brinelled, it was found to be around 120 or 130; that is, too soft for good machining. There is less and less of the S. A. E. No. 1020 and No. 1045 steels being used today.

Coming to the alloy steels: We find that practically all medium carbon alloy steels with the same Brinell hardness machine about the same, until we come to steels with a Brinell hardness of from 280 to 300 and higher, in which case the molybdenum steels are somewhat superior to any of the other alloy steels for machinability.

Coming to the tool steel classification: We find ordinary plain carbon tool steel to be the most readily machined. The next type is tool steel with around $\frac{1}{2}$ per cent chromium. The third steel on the list is vanadium tool steel. We use this steel for tools requiring considerable resistance to shock. The various types of oil-hardening steel follow in order of machinability.

Bearing steel is next on the list, followed by low tungsten tool steel. We then come to high speed steel, and finally the high carbon high chrome steel, such as 2 per cent carbon and 12 per cent chrome material.

The next factor is that of the cutting fluid. This subject has been considered of such great importance by the A. S. M. E. that a couple of years ago they appointed a sub-committee to investigate various cutting fluids. The A. S. M. E. sub-committee has issued two very interesting and important bulletins since that time. They classified cutting fluids into the following divisions:

The first type is known as dry cutting. That is, cutting without a cool-

(Continued on page 110)

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Uses of the Sine Bar

By A. E. MOUGEY

THE sine bar is frequently mentioned in trade journal articles, but it is quite probable that the number of readers who are actually acquainted with the uses and possibilities of this tool is comparatively small. The sine bar must be understood to be appreciated, and it is probable that if all toolmakers were aware that the use of the sine bar reduces the dimensions of angle from guesswork to actual figures in thousandths of an inch, they would rely upon its extreme accuracy rather than on the protractor. In other words, a sine bar is to the protractor what the micrometer is to the scale.

The body of the sine bar should be made of machine steel, pack-hardened and ground, and should be drilled and

ing; if too much stock is ground or lapped off from one surface, the error can be corrected by taking more stock off the opposite side. The dimensions between buttons must be held to the highest degree of accuracy.

The sine bar shown in the illustration is $6\frac{1}{4}$ in. long, but is called a 5-in. bar because the dimension from center to center of the buttons is 5 inches. The bar can be made any length, but either 5 or 10 inches will be found easy to compute. If it is desired to machine a piece of work at an angle of 35 deg. 20 min. from a given side or surface, first look up the sine of this angle, which will be found to be 0.57833, and multiply by 5—the length of the bar—thus obtaining 2.8916 in. Set a height gage or set of gage blocks

to this dimension and then place upon it one of the buttons, supporting the hook end of the sine bar with the other end resting on the other button as shown in Fig. 2. The bar is now accurately set at

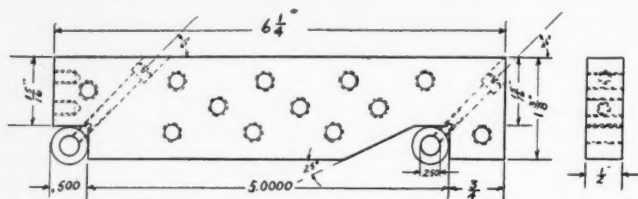
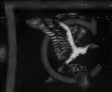


Fig. 1—Design of Sine Bar

tapped at convenient locations so that it can be fastened with screws to an angle plate when necessary. These holes also make the bar lighter and relieve hardening strains. The bar is used with two discs or buttons which should be made of tool steel, also hardened and ground, with the center holes lapped out so that a plug gage can be inserted. The buttons must be identical in every respect. There is little danger of spoiling the bar in the mak-

ing the desired angle, and can be clamped to an angle plate. The work is placed in position on the sine bar and then it, too, is clamped to the angle plate, after which the sine bar can be removed and the work machined.

If the work is of such nature that it is impossible to rest one button on the surface plate or machine table, the sine bar may be turned over and the height gage used to gage over the buttons. Or the buttons may be



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clamped in their seats in the angles of the sine bar and plug gages inserted

easily be seen that the sine bar can be used to reproduce any desired angle within extremely close limits, the degree of accuracy being limited only by the accuracy with which the sine bar and buttons are made.

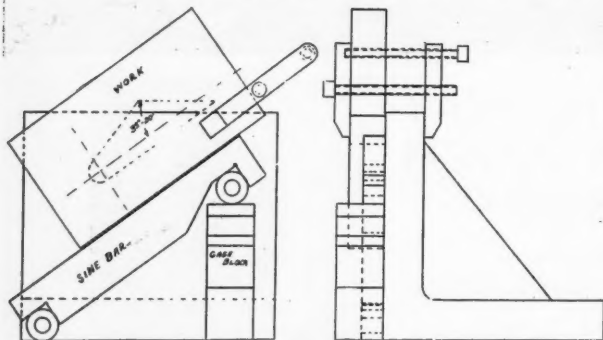


Fig. 2—Showing how Sine Bar is used to locate work at the proper angle.

into the holes, the height gage being used to gage over the plugs. It may

prevent it from rusting and avoid any possibility of warpage.

Tool Shop System

(Continued from page 32)

space provided for it and is taken from the job time tickets. The workmen's clock numbers are shown in the column at the left. Customers are promptly invoiced for either partial or complete shipments as shipping memoranda is received from the shipping department.

Each cost sheet is good for the job to which it applies for one month, as indicated by the 31 day-columns provided for listing the amount of time put in on the job. If a job lasts less than a month, the totals are posted in the left-hand corner of the sheet under the caption "Current Month," as shown in the illustration. If the job runs over into a second month, another sheet is made out for this job and the totals for the current month are posted under "Brought Forward"

on the second sheet. Thus as many sheets can be used as there are months in which the job is in process, and the postings can be carried on indefinitely.

The blackboard over the work bench shown at the head of this article was intended to accelerate deliveries, and has fully justified its existence. Each job that goes to the shop is listed by order number on this board and the date of delivery is indicated by a cross made with white chalk in the column under the date. Each day that the job remains in the shop past the due date, a cross is made in red chalk, and, of course, all possible effort is made to prevent any red crosses from appearing.

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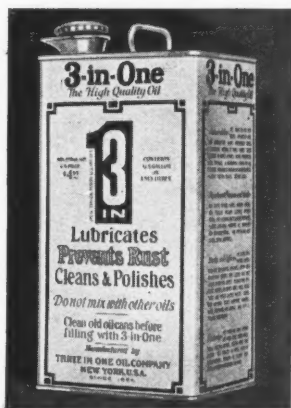
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scientific process. That's why no plain mineral oil can furnish such complete protection.

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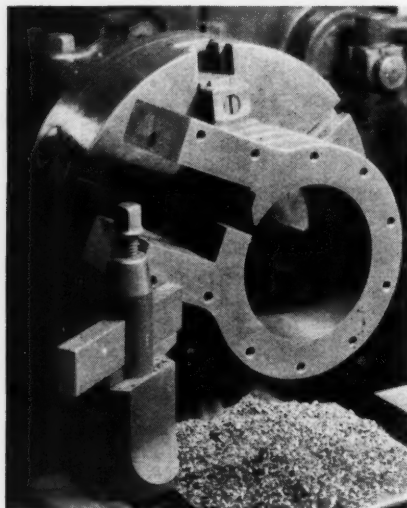
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FOR INDUSTRIAL USERS

Fansteel Products Company Announces Ramet Cutting Metal

AFTER some fifteen years of development work which involved the production of tantalum on a commercial scale and within practicable limits as to cost, Dr. C. W. Balke of the Fansteel Products Co., Inc., North Chicago, Ill., has developed a hard,



Stage Ring for Central Scientific Company "Hypervac" Vacuum Pump (semi-steel casting), finished faced and bored in one cut with Ramet-tipped tool, taking a 5/32-in. cut. Note intermittent nature of facing cut.

wear-resisting material which has been given the trade name of "Ramet." The principal constituent of Ramet is tantalum carbide, which is of substantially the same hardness as tungsten carbide, but is said to have a much higher melting point. The melting point of tantalum carbide is 4,400 deg.

C., which is higher than the melting point of anything else excepting carbon.

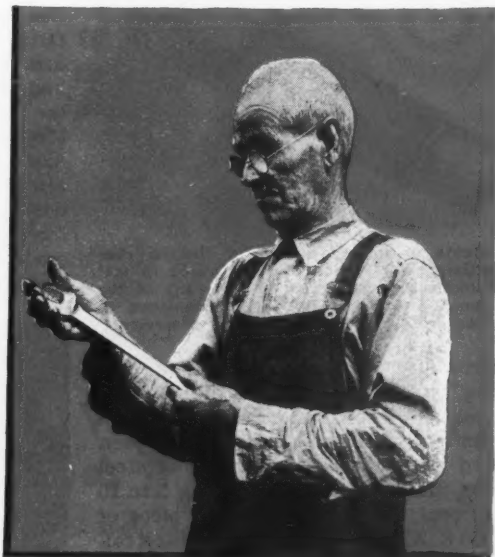
Aside from the high melting point, the outstanding characteristics of tantalum carbide are its low thermal conductivity and the fact that it resists fusion with other metals. In the untreated state it cannot be soldered or brazed to other metals, and regardless of the amount of heat generated in cutting, chips from the work will not alloy with it. As it does not readily conduct or absorb heat, a tool of Ramet will remain much cooler than the chips produced by it. Ramet will turn a bar of nickel steel at high speed, producing a continuous ribbon of bright red chip, and after a cut of several minutes' duration the tool can be removed and held in the hand.

Ramet tips are mounted on shanks in the same manner as other carbide tips—by the brazing process. Ramet has to be prepared for the brazing process, however, by heat treating in a controlled atmosphere and nickel plating. The nickel acts as a binder for the brazing process. Ramet tools can be ground to any angle that is satisfactory for other tools. The low thermal conductivity makes it possible to design tools with sharp cutting angles, which in turn makes possible the construction of general service tools, thus avoiding necessity for special tools for each operation. As Ramet is slow to absorb heat, the heat of operation will not soften the brazing which fastens the tip to the shank of the tool, consequently Ramet tools may be operated at high speeds and feeds

A Simple Way To Be Sure About Wrenches

WRENCHES are too important an item of equipment for careless experiment. Old-timers found that out long ago, and likewise found a simple method of making sure about the wrenches they buy and use. They look for the **WILLIAMS** name and the Diamond W Brand.

For nearly a half century this trade-mark has identified good tools. New designs and new materials have been added to the Williams' line, but the traditional high standard of quality and workmanship has been rigidly maintained. Be sure about *your* wrenches—look for the Williams' Brand.



J. H. WILLIAMS & CO.

"The Wrench People"

75 Spring St. New York

Western Warehouse:
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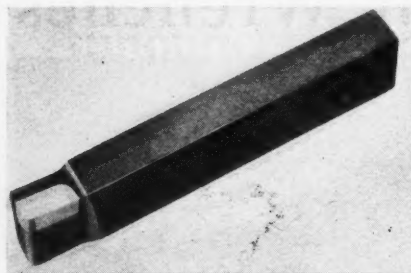
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Buffalo, N. Y.

Buy
from your
Distributor



WILLIAMS
SUPERIOR DROP-FORGED TOOLS
DROP-FORGED
WRENCHES

without fear of loosening the Ramet tips. Certain types of operations that have been considered very difficult



Because of its extremely low thermal conductivity, Ramet tips may be brazed to tool shanks with pure copper or with any of the common brazing alloys, with a minimum of danger of the tips coming off in service.

heretofore, such as intermittent cutting, turning hardened high speed steel, and so on, can be machined successfully with Ramet. Ramet has been used successfully on all kinds of steel jobs, including steel containing 5 to 15 per cent manganese. A 3-in. piece of 1050 S. A. E. steel, which contains a relatively high low percentage of carbon, was turned to 2 in. in one cut within a limit of 0.001 in., the tool leaving a finish which resembled that left by a grinding wheel. On a similar piece of work, with a $\frac{1}{2}$ -in. cut, 0.020 in. feed and running at a speed of 170 ft. per min., a tool ran for three days as a demonstration and at the end of that

time showed no signs of wear. The life of the tool between grinds is equal to that of any other cutting metal.

The Fansteel Products Company is a metallurgical producer, not a tool manufacturer, and confines its activities to the production of Ramet. Arrangements have been made by this firm with a limited number of tool-making firms to make the tools for the trade, the Illinois Tool Works and McCrosky Tool Corporation being the first two to be licensed. Ramet will also be sold to any manufacturer who wishes to manufacture Ramet tools for use in his own plant, but the process of manufacture involves the use of special equipment for this purpose.



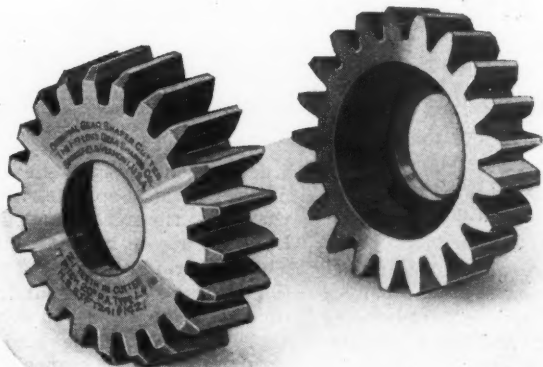
Facing and boring a 33-in. chill for car wheels, using a Ramet tool which removes $\frac{1}{8}$ in. of hard scale and metal in one cut. A car wheel chill is the ring-shaped casting into which the car wheels are poured and is of the same grade of hard cast iron as the wheels themselves.

Diamond Vulcanized Fibre Catalog

The Continental Diamond Fibre Company, Newark, Delaware, has issued a catalog which is intended to acquaint the mechanical industries with the properties of vulcanized fibre, the manner in which it is made, and the advantages of it in use. The text includes a comprehensive description of the processes involved in the production of fibre, with illustrations of the machinery and other equipment used in manufacturing. A chapter is devoted to the uses of vul-

canized fibre, with a partial list of the parts that are made from it. Instructions are given for machining fibre, and a number of tables are included, giving weights of fibre in its various forms. The book contains forty 6 x 9-in. pages.

Advertisers like to know whether or not their advertisements are being read. When inquiring about machines, tools, or equipment advertised in this magazine, please mention MODERN MACHINE SHOP. Your cooperation will help to build up a bigger and better magazine for your own benefit.



It Is Not So Much What a Tool Costs But What It Does That Counts

THE initial cost of a cutting tool, such as the Gear Shaper Cutter, has comparatively little bearing on the cost of the product it produces; providing the gears cut are good enough to pass inspection and are suitable for use in the completed unit.

That is the crux of the entire situation. If passable gears are assured, the initial cost of the cutting tool is of minor consideration. Quality is not obtainable on a price basis.

A quality product is always worth what it costs and this is especially true of original Gear Shaper Cutters—there can be no compromise with accuracy in gear cutting.

Replace your worn out cutters with Original Fellows Gear Shaper Cutters—accept no substitute.

THE FELLOWS GEAR SHAPER CO.

78 RIVER STREET, SPRINGFIELD, VERMONT
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Ideas From Readers

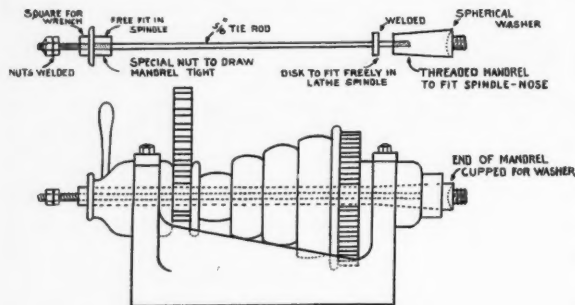
This department is a clearing house for ideas. If there is a "kink" or short cut in use in your shop, send in a description of it. We will pay \$5 for each one published.

A Handy Nut-Facer

By EDMUND LEDUC

ALTHOUGH it is possible to face nuts on almost any kind of make-shift mandrel, the vast number of faced nuts that are required every day on locomotives and other machinery would seem to justify the use of better equipment than is ordinarily

vided which fits into the taper in the nose of a lathe-spindle, thus insuring that the threaded part upon which the nuts are to be held will run true. The mandrel is prevented from working loose or turning under pressure of a cut by a tie rod which passes through the spindle and is drawn tight by means of a special nut at the rear end. A disc, of a size that will fit freely in the spindle, is provided near the front end of the tie rod so that the rod can easily be threaded into a tapped hole in the rear end of the mandrel. Having a right-hand thread, the tie rod tightens in the hole if the mandrel should start to turn under pressure of a cut.



Special Mandrel for Facing Nuts.

assigned for this job. The machine used for nut-facing is usually a small lathe that is too badly worn to be of further service on regular work, although the usual requirements for a nut-facer are that the nuts be faced square with the threads and that provision be made for quickly and easily changing the mandrels for different sizes of nuts. The illustration shows the equipment that is used for this operation in a locomotive shop where the importance of accurately-faced nuts is not under-rated.

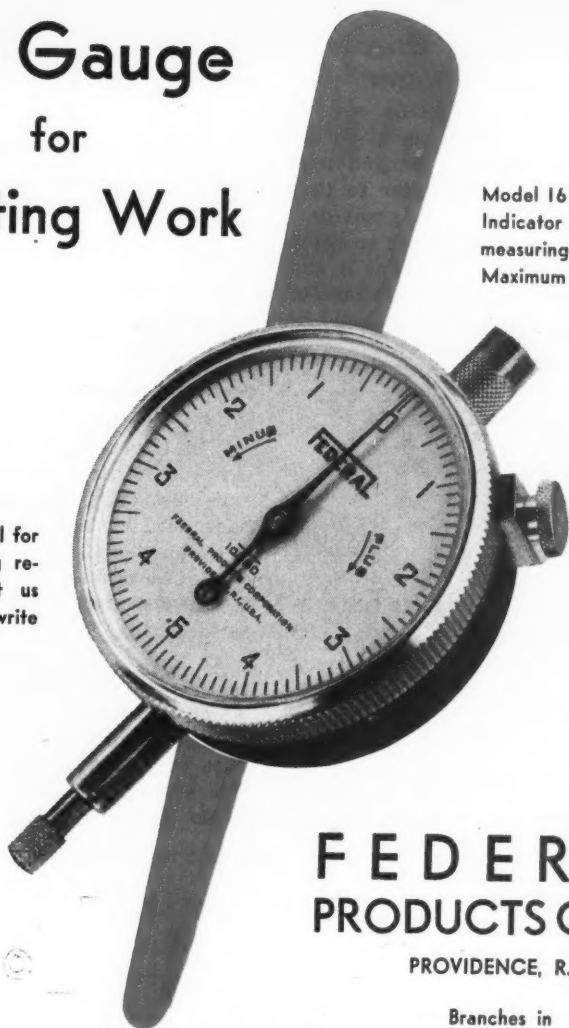
To hold the nuts, a mandrel is pro-

vided, as shown, and a washer that is spherical on one side and flat on the other is slipped over the threaded end with the spherical side next to the cupped shoulder. The hole in the washer is enough larger than the threaded section so that the washer can adjust itself to the face of any nut that is not tapped square with the thread, thus providing a full bearing for the nut. A $\frac{3}{8}$ -in. iron rod with a copper tip on the end is used to drive the mandrel out of the spindle-nose when necessary to change mandrels.

The Gauge for Exacting Work

Model 16 "Federal" Dial
Indicator for accurately
measuring $1/10,000"$.
Maximum range, $.200"$.

There is a model for
every gauging re-
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BUILT LIKE THE FINEST OF WATCHES

Spinning Flanges On Shells

By CHARLES H. WILLEY

THE filling of an order for several thousands of meters involved the production of as many flanged tops for the meter cases, similar to that shown at A in Fig. 1. A great deal of experimenting was done in an effort to form the shell as shown at B and flange it as shown at C by means of a die in which the operation could be performed rapidly. However, the press

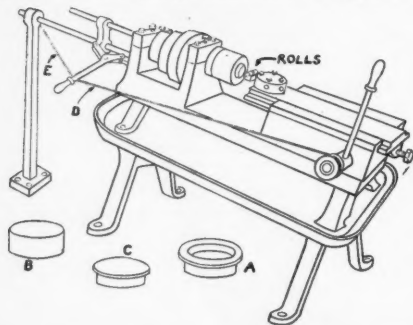


Fig. 1—Equipment for spinning flanges on shells.

operation left a stress line on the fold that could not be buffed out, and as the tops were to be nicked and polished, the stress line caused them to be rejected. Being unable to solve the problem by the use of the press, we turned to spinning, and to our surprise found that the flanging operation could be performed as cheaply by this method as we had hoped to do it with the press.

The method of chucking and spinning the piece is shown in Fig. 2 and 3. The piece shown as A, Fig. 2, is a

nose over which the shell or cup is placed, the nose being held in position by a heavy spring which can be com-

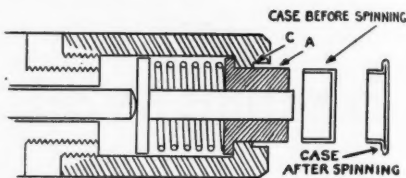


Fig. 2—Ejector rod through spindle forces nose out when piece is finished.

pressed by means of the ejector rod through the spindle.

With the cup in position on the nose, the rollers are forced against the closed end of the cup, forcing the nose back until the edge of the cup strikes the shoulder C. As the pressure is continued against the cup, the metal is flattened and the flange is formed as desired.

As the rolls are moved away from the finished piece, the cable D, Fig. 1, which is attached to the ejector handle, pulls the handle and forces the nose out, ejecting the finished piece. The spring E pulls the handle back again as the rolls are fed up to the

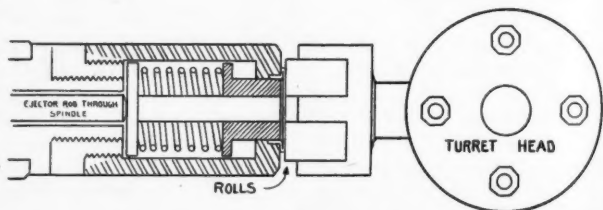


Fig. 3—Showing how the rollers spin the flange as the spindle revolves.

next cup. Splendid results have been obtained; the pieces are turned out at a speed of 1,000 pieces per hour, and so far this equipment has produced 100,000 pieces.

You Can't Rebuild Forever And Still Make The Grade

Because chuck parts are interchangeable it does not necessarily follow that they can be replaced forever and a day and still maintain the proper balance and co-ordination of the chuck unit as a whole.

Some old chucks have been rebuilt so much and so often that the various replaced parts are not even related to each other.

When both elements of a thread become worn, as they are sure to be over a period of time, it is not helping matters much to replace a new thread in a worn thread way.

An old, worn chuck is a potential source of loss. It fails to hold tools or work firmly, necessitating frequent tightening of the jaws which "chew" the work, or tool shanks, representing a complete loss of material and time.

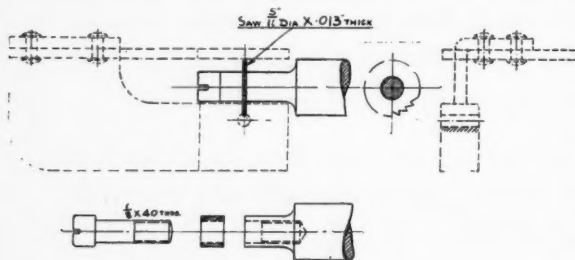
Your dealer has a man who is conversant with the wide variety of chucks available for the many types of specialized jobs encountered in production work.

The CHUCK MANUFACTURERS of AMERICA

An Unusual Sawing Operation

By ROY VERNON WADE
Glasgow, Scotland

THE illustration shows the method we used to perform a sawing operation, using a very small saw, in unusually close quarters. The part



DETAILS OF ABOVE

An Unusual Sawing Operation.

upon which the operation is performed is made of two pieces of annealed steel, riveted together, and, as the hole is of importance in the locating of the finished part, it was decided to pierce the hole and mill the slot after assembly. In order to use a larger saw, it would be necessary to bend the part at an angle and straighten it after the cut had been made. Owing to the high cost, however, the latter idea was discarded.

The saws used are of .85 carbon steel and are 0.013 in. thick by $\frac{1}{2}$ in. in diameter. The stock at the point of cutting is $\frac{1}{2}$ in. thick and the depth of the cut is $\frac{1}{2}$ in. The rate of feed is $3\frac{3}{4}$ in. per min., with the cutter operating at a speed of 3,200 r.p.m. A machine with cam-operated feed is used and each saw will cut approximately 1,000 parts before it is too worn for further use.

The saw was held on a special arbor, one section of which was threaded to screw into the other section, as shown in the illustration. A slip bushing allowed the necessary pressure.

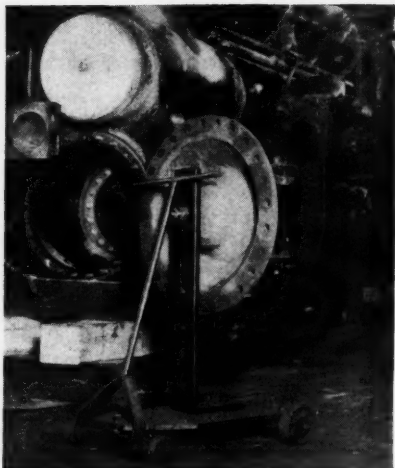
Cylinder Head Wagon

By H. H. HENSON

THE accompanying illustration shows a cylinder head wagon which is worth its cost many times over in the saving of time and labor. In locomotive repair shops where a policy has been adopted of inspecting the reciprocating parts every ninety days, this device is an absolute necessity.

The wagon consists entirely of metal parts, the platform consisting of a section of heavy boiler plate and the handle being of welded construction. To the platform is bolted an L-shaped piece of flat,

wide bar stock, in the vertical section of which is a long slot. When it becomes necessary to remove a cylinder head, the wagon is backed up to the cylinder, the stud that is found in the cylinder head is inserted



Wagon for handling cylinder heads.



NEW HYDRAULIC FEED MULTI-SPINDLE DRILLER

Shown above is a Model B-225-H NATCO Hydraulic Feed Multiple Spindle Driller. It is a comparatively small "multiple" which can be furnished with either a 10x16 or 12" round head bored for 16 spindles. Machine has a capacity of approximately 16-3/16" drills in cast iron. Write for complete information on this new machine.

"NATCO Solves Your 'Hole' Problem"

THE NATIONAL AUTOMATIC TOOL CO.
RICHMOND, INDIANA, U. S. A.

into the slot in the vertical bar and fastened with a washer and nut, and the head is then removed from the cylinder. If the nut is properly tightened, the stud will not slip. After inspecting, the head can be replaced and as the head is at the correct height and the stud holes are in proper alignment, the task is comparatively simple. The use of this wagon renders any lifting unnecessary.

In large roundhouses it is common practice for the inspection job to be handled by two or three gangs, consequently four of these wagons will be ample for roundhouse use. The cost of construction is so low as to be negligible, as most of the parts can be pulled out of scrap or made up in a short time.

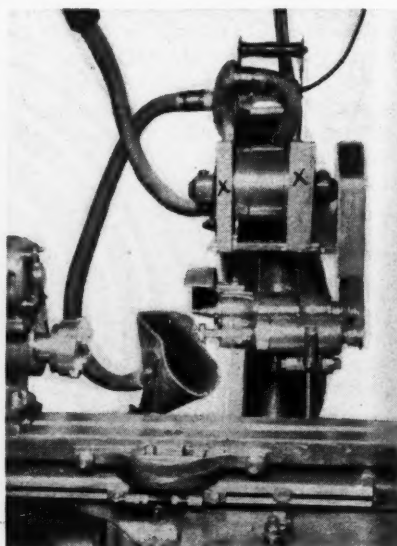
Dust Collector Made From Vacuum Cleaner

By J. C. HART

THE illustration shows how an old hand vacuum cleaner was utilized as a blower system to carry off the dust from a small tool grinder. There was no blower attached to the grinder, and some method of carrying off the dust was necessary. The cleaner was one that had been built for cleaning the upholstery in automobiles, and was of somewhat heavier construction than the ordinary household vacuum cleaner.

The parts marked X form the frame in which the motor that drives the grinding wheel is supported. The vacuum cleaner was bolted to a pair of legs which were, in turn, bolted to this frame. The hose was attached to a funnel which was anchored to the machine by means of a bolt and bracket so that it could be adjusted to any desired position. The exhaust hose was connected with an overhead pipe that carried the dust out-of-doors. The exhaust could, however, be car-

ried to a can that had a few inches of water in it to catch and hold the dust, if the machine were too far away



Vacuum cleaner serving as blower system.

from the wall to run the exhaust pipe out-doors. The machine is shown set up with an internal grinding attachment. This vacuum cleaner proved highly efficient, carrying off the dust as well as it could have been carried off by an elaborate blower system.

Ventilator Made From Carbide Drums

By F. J. FITZGERALD

LIKE old safety razor blades, empty carbide drums look so potentially useful that you hate to throw them away. To the already lengthy list of uses for carbide drums, another has recently been added by an ingenious southern welding organization.

Needing several yards of ventilator or exhaust piping in the welding shop,

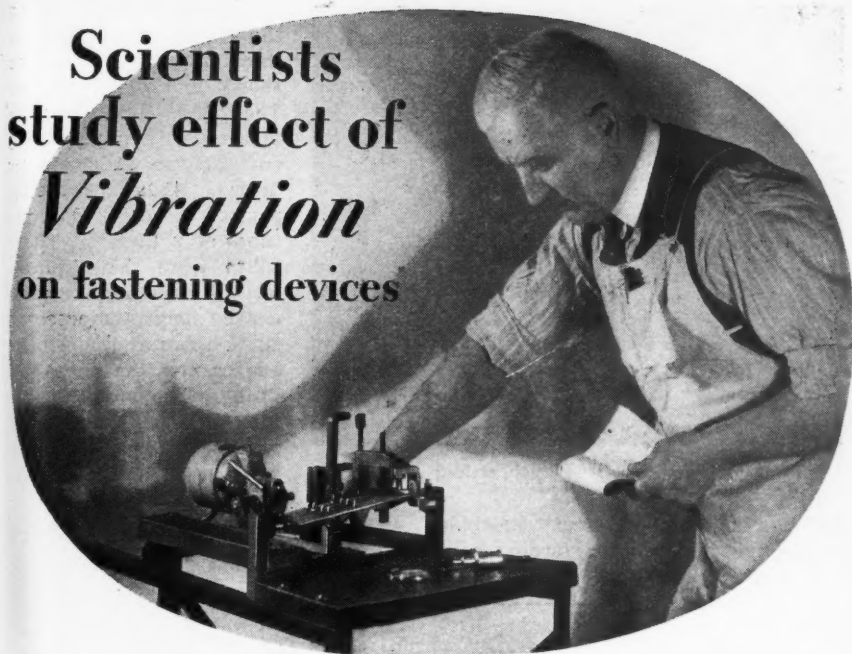
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Scientists study effect of *Vibration* on fastening devices



"It is evident that fastenings made with Self-tapping Screws will resist vibration much better than machine screws" say authorities of the COLLEGE OF ENGINEERING OF N. Y. U. after tests.

FOR weeks scientists of the College of Engineering of New York University studied the holding power of fastening devices. By unbiased tests they were to determine whether Self-tapping Screws, noted for economy in assembly work, have greater or less holding power than the fastening devices they usually replace.

Particular attention was given to the effect of vibration, for it is the chief cause of fastening failure. The specially constructed vibrating machine, shown above, was run more than a hundred hours under close observation. Four test specimens were subjected to the vibration—each specimen containing two sizes of Self-tapping Screws, and an equal number of the equivalent sizes of machine screws, the most common alternative means of fastening.

Early in the test the majority of the fastenings made with machine screws failed. Yet not a single Self-tapping Screw loosened. The report of the authorities conducting the test states:—"It is evident that Parker-Kalon Hardened Self-tapping Screws will resist vibration much better than the conventional machine screw".

Detailed information developed from the extensive tests made at N. Y. U. of the comparative strength of fastening devices under stresses of vibration, tension and shear will be found in the booklet offered here. The coupon brings it, free; with another helpful booklet showing the large savings gained on metal assemblies through the use of these unique Screws that eliminate tapping, fumbling with bolts and nuts and other fastening difficulties.



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Dept. E., 192-196 Varick Street, New York, N. Y.
Send me free booklets on the Security and Economy
of assemblies made with Self-tapping Screws.

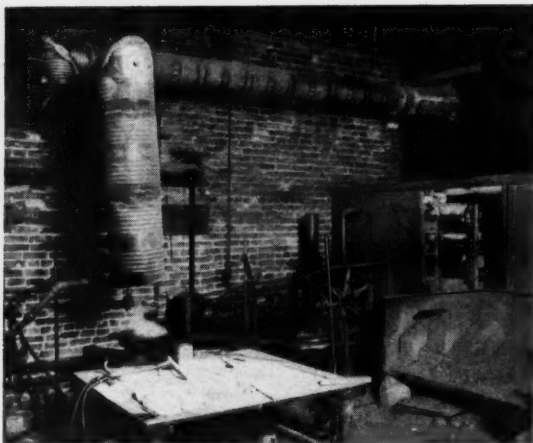
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PARKER-KALON
HARDENED
Self-tapping Screws

MAT IN U.S. AND FOREIGN COUNTRIES

"Distributors Serve Industry Economically"



Ventilator made of carbide drums, welded together.

and having many empty carbide drums lying about, the owners con-

works perfectly and keeps the shop free from smoke and fumes.

Building the "Intertype"


(Continued from page 38)

rix. He places the matrix in a holder in a machine where a 12,000 candle-power spotlight is thrown upon it and reflected back on a screen, in the process of which the reflection is enlarged $62\frac{1}{2}$ times, or $\frac{1}{16}$ in. for each 0.001 in. of actual measurement. Thus a character which is actually $\frac{1}{8}$ in. high is approximately 8 in. high in the reflected image, and any imperfections are magnified accordingly.

By moving a lever, the face of the matrix is brought up to the focusing point and the matrix is adjusted so that the reflection will come within certain lines that have been laid out on the screen. Then the character, in turn, is reflected and the position of it in relation to the position of the matrix-face noted. If the reflection

shows that the character is not in the correct position on the face of the matrix, the necessary adjustment is made on the stamping machine. Figure 17 shows a reflection of the mold of a letter "X" as stamped in the face of a matrix. The horizontal lines on the vertical scale on the screen are graduated for each 0.001 in. on the face of the matrix, as are also the close vertical lines. These lines and graduations enable the operator to discover at a glance whether or not the mold is perfect and properly placed.

Advertisers like to know whether or not their advertisements are being read. When inquiring about machines, tools, or equipment advertised in this magazine, please mention MODERN MACHINE SHOP. Your cooperation will help to build up a bigger and better magazine for your own benefit.



How Can a Fellow Get These Hack Saws When He Has Never Had Them Before?

Well, let's say it's a high speed steel blade you want; why not tell your Tool Room man or your Buyer that you think it would be a good idea to try an order of **SIMONDS RED STREAK** High Speed Steel Blades — the blade with the **RED BACK EDGE**. Leading supply dealers have them in stock, or can get them for you.

That's one sure way of finding out just how these blades cut. You've read about them — you might as well see for yourself.

SIMONDS SAW and STEEL CO.

"The Hack Saw Makers"

Established 1832

Fitchburg, Mass.

LOOK FOR THE HACK SAWS Trade Marked in **RED** **SIMONDS**



This Six Foot RED S Metal Saw Satisfies J

This enormous blade of Simonds Steel with te
Steel and curved gullets meets the demand for
ting in one of Japan's foremost manufactu
performance, cutting tough metal, improves
national reputation. The finest metal saw eve

*When you have a metal cutting problem, write
our recommendation regarding the use of saws*

SIMONDS SAWS and STEEL
"The World Largest Saw Makers"

Established 1832

Fitch

SIMONDS

Inserted Tooth Metal Cut

WE'D like to have readers of this magazine try their hand at writing jingles about the new Simonds windowless factory. Here is one written by a man for a leading daily newspaper:

*"In short, regardless of the sun,
That plant will not depend upon
Outside illumination.
And so it's very plain to see
That making Simonds Saws will be
A paneless operation."*

Send your jingles to Simonds Saw and Steel Company, Fitchburg, Mass.

* * * * *

THE new Simonds windowless factory, when completed will operate on two shifts. Working hours will be divided so that each shift of workmen will have ample time for outdoor daylight activities.

* * * * *

OF course you are familiar with the now famous Simonds Inserted Tooth Metal Cutting Saw. This is the new design saw with the curved gullets and high speed steel teeth. Chips do not weld to the sides of the teeth or the plate.

SIMONDS—the World's largest saw makers are also the makers of the World's largest saws. Recently a section tooth pattern circular saw 120 inches—10 feet high—was completed for use in sawing the big logs from trees on the Pacific Coast. Simonds makes saws of every description in standard sizes, both for wood and metal cutting.

* * * * *

EVERY little while we receive letters from mechanics praising that new High Speed Steel Hack Saw—the one marked with the red on the back edge. Men tell us they get 10 times more service from this blade and they save a lot of time on the machines. These are long lasting blades that stand faster feed and speed.

* * * * *

NEXT year this company will observe its 100 years of continuous business. From a little one-room shop to a plant covering many, many acres of ground—that's the history of Simonds progress. From just scythe makers for New England to saw makers to the world. That's Simonds reputation and high quality products.

RED STREAK sifies Japanese

Steel with teeth of High Speed
ne demand for heavy duty cut-
ost manufacturing plants. In
al, improves up to its inter-
metal saw ever used.

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S and STEEL CO.
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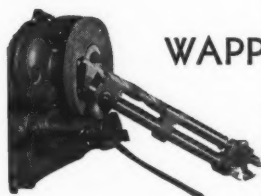
Fitchburg, Mass.

ND S

eta Cutting Saws

A NEW TWIST DRILL GRINDING ATTACHMENT

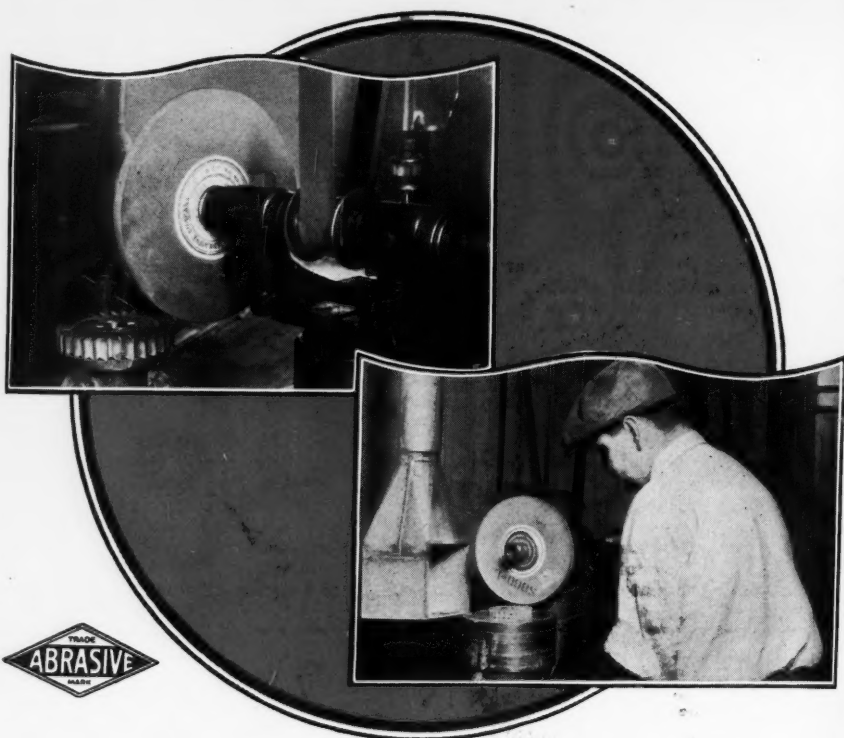
BY
WAPPAT INC.



This attachment has been designed for use with the Red Streak Bench Grinder. It will quickly and accurately grind all twist drill bits from $\frac{1}{8}$ " to $\frac{13}{16}$ " diameter. It is a real precision tool yet is simple to operate. This equipment is essential for every shop using drills of any kind. Write WAPPAT Inc.

WAPPAT Inc.

Division Simonds Saw and Steel Co.
7522 Meade Street Pittsburg, Pa.



ABRASIVE COMPANY GRINDING WHEELS used for Precision Work

Abrasive Company Grinding Wheels help the man in the tool room to do accurate work. You can depend on them to grind fast and leave a uniform finish.

S. B. Borolon Wheels are preferred for grinding hardened and high speed steel such as tools, cutters, drills, dies and various other precision parts.

Ask for illustrated folder "Tool and Cutter Grinding"

ABRASIVE COMPANY

DIVISION SIMONDS SAW and STEEL COMPANY

Tacony & Fraley Streets

Philadelphia, Pa.

Over the Editor's Desk

A Crying Need

PROBABLY the most unsatisfactory single item in machine shop operation today is the limited knowledge of cost accounting to be found in the industry. This lack of knowledge affects not only the shop or individual directly concerned, but it indirectly affects all the rest of the industry. The average operator of a small or medium-size shop is an engineer or mechanic—not a cost accountant—and if he started in a small way he has, in most cases, devised a system of his own to fit what he considers his own peculiar needs. The result is that there are almost as many different “systems” of cost-keeping in use as there are shops—and most of them are woefully inadequate. Many so-called “systems” include no fixed charges for overhead, and the number of shop operators who make an allowance for depreciation as a part of their costs is, comparatively, small indeed.

Some of these shop owners and managers are aware of their need, and welcome any information that will help them to operate in a more business-like manner. Others refuse advice, dismissing any suggestions with “Our system tells us all we want to know,” probably feeling, secretly, that cost-keeping is a “lot of hooey” and that if you can buy a mechanic’s time for eighty cents an hour and sell it for a dollar and a quarter, you must be making money.

And so they go blissfully on, discarding a machine now and then as it wears out, and hoping to have enough surplus, some time in the future, to buy new ones. Then when the sheriff comes along and closes them up, their song forever after is “You can’t make anything in the machine shop game any more.”

And so you can’t, if you operate a shop that way. Nor can this state of affairs be blamed on the purchasers. No square-shooting manufacturer wants to buy parts, or machines, or tools, from a shop operator whom he knows is selling at a loss. He secretly feels sorry for the other fellow and if pressed hard for the order may give it to him, but the large manufacturer knows full well that the operator who is marketing his service below cost is headed for oblivion.

As the purchasing agent of a large electrical manufacturing plant in Chicago said recently, “We don’t want to deal with shop managers who can’t figure their costs. We don’t want to buy tools at a price that will not afford a profit to the seller. No plant can operate without making a profit and stay in business, and we are much more interested in seeing these plants continue in business so that we can depend on them when we need them than we are in trying to force them out of business. We make a profit in our own business, and we expect the other fellow to do the same.”

On page 20 of this issue is a description of the cost system in use in a well-known tool shop in Chicago. This system is peculiarly adapted to the needs of the tool, die, and special machinery shop, although it is just as efficient for the production plant, and is one of the few small shop systems we have ever seen that takes account of every factor entering into manufacturing costs. The outstanding feature of the system lies in the fact that it can be operated with no other clerical or office help than a bookkeeper. If this article does not seem clear enough, we have no doubt that Mr. Hack will be glad to answer any letters, or we will undertake to obtain the necessary information for anyone interested.

New Shop Equipment

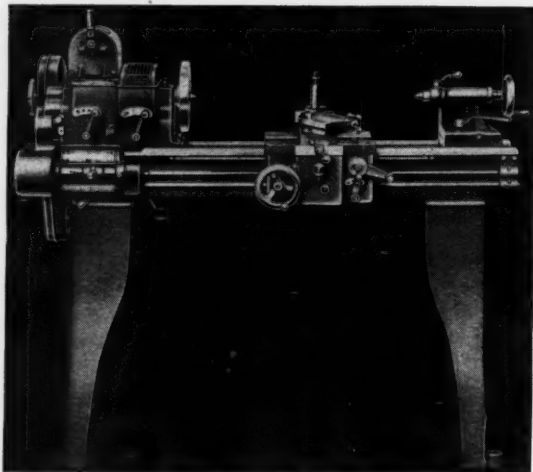
LeBlond Announces "Regal Line" of Engine Lathes

The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, has announced a new line of engine lathes to be known as the "Regal" line. The Regal lathe is an exact counterpart of the regular LeBlond lathes of the larger size, but is especially designed for use in general

is provided through a self-contained motor located in the rear of the head on the upper part of the leg, and is transmitted by means of a multiple V-belt drive.

Every part of the lathe was designed to afford the utmost safety both to the operator and the machine. Extra strength is provided in the feed mechanism where excessive strain might occur due to errors by inexperienced operators, and a safety pin is provided in the feed gear train. The application of a feed rod takes the wear off the lead screw, leaving the screw for cutting threads. The carriage has unusually long bed-bearings with a wide, deep bridge to withstand the pressure of the tool under cut. Although of the conventional type, the bed, which is of close-grained iron alloyed with steel and nickel, is heavy and unusually rigid. The headstock is a box casting, reinforced and with the main drive shaft and intermediate shaft bearings cast integral with the head so that the shafts cannot get out of line. The drive shaft runs in phosphor bronze bushings, oiled by the splash from the gears. The high carbon steel spindle has eight changes of speed, obtained by sliding gears without the use of jaw clutches. Four sliding gears provide changes of speed to the intermediate shaft. The head cannot be wrecked by engaging two sets of gears at the same time.

Cross girths at close intervals joining the two I-beam sections enable the lathe bed to resist twisting or torsional strains. The rear V on the bed keeps the head and tailstock in alignment, whereas the front V guides the carriage. The carriage is gibbed front and rear. The bridge is wide and deep to withstand the pressure of the tool under cut. The graduated tailstock top is keyed to



LeBlond "Regal" Engine Lathe

service shops, schools, automobile repair shops, experimental laboratories, and other places where light manufacturing is done or where a light lathe is needed. The features of the tool are compactness of design, safety, and simplicity of control, combined with unusual precision.

The Regal lathe is built in five sizes, ranging from 10-in. to 18-in. It has an 8-speed selective geared headstock, in which normalized and hardened steel cluster gears are used. The final drive from the intermediate shaft to the spindle is through helical-type gears. Power

When You Specify

The Cincinnati

HIGH SPEED

Cut-Off Machine

... you are sure of getting a machine that will cut all kinds of materials ... and cut fast!

It is ideally suited for cutting steel alloys, brass, copper, aluminum, as well as fibrous materials of all kinds and sizes up to 2-1/4" inclusive. Graduations on the table make angle cutting up to 45° as accurate and fast as straight cutting.

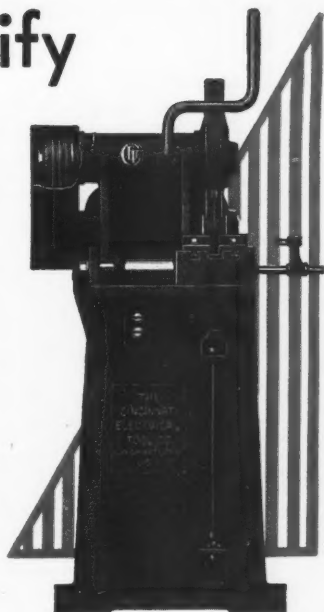
"THE CINCINNATI" Cut-Off machine uses 12 or 14-inch diameter abrasive wheels operating at peripheral speeds of from 15,000

to 18,000 S. F. M. The cutting off wheel is completely guarded except for that portion necessary for the cutting operation.

Get all the facts on "THE CINCINNATI" Cut-Off Machine. Send the coupon for a bulletin!

The Cincinnati Electrical Tool Co.

Division of The R. K. LeBlond Machine Tool Co.
2708 MADISON ROAD CINCINNATI, OHIO



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Nut Setters, Tap-
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Aerial Grinders,
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Bench and Floor
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2708 Madison Road, Cincinnati, Ohio.
Please send bulletin on "THE CINCINNATI"
Cut-Off Machine.

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Firm.....
Address.....
City..... State.....

the bottom, with provision for set-over for taper turning. The hole in the tail-stock spindle is Morse taper, to facilitate the use of drills and reamers with Morse taper shanks.

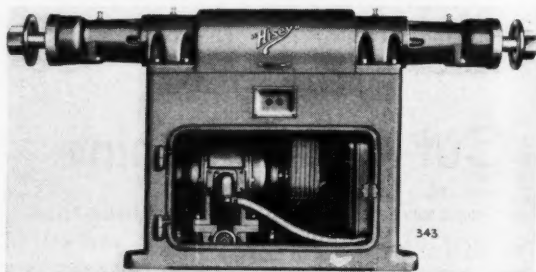
The crossfeed screw controls movement of the compound rest in either direction by hand or power for facing or cutting off. The compound swivel slide is graduated in degrees and may be set at right angles to the cross slide or at any angle for boring short, steep tapers. The top slide has screw adjustment with graduated collar reading in thousandths of an inch.

To guard against breakage, the feed mechanism has practically the same quick change box and apron used for many years on LeBlond heavy duty engine lathes. Frictions in the apron have been replaced by a positive pinion-type clutch which makes it impossible for the feed to engage of its own accord. Cross and longitudinal feeds cannot be engaged simultaneously, nor can both the feed rod and lead screw be engaged. All gears in the feed train, including the rack, are cut from solid steel. The feed or lead screw can be reversed by the movement of a lever which reverses the tumbler gears on the headstock casting, and a slip gear on the quadrant provides two ratios of gearing to the quick change gear box, which can be made without removing the cover.

The quick change box is a complete unit bolted to the front of the lathe bed. Two levers control 24 changes of feed and thread cutting; by using the slip gear on the quadrant, 48 changes are possible. All apron gears run on heavy studs having extra long bearings in the apron plate to prevent cramping. The taper attachment, which is of the carriage type, is mounted on the rear of the carriage. The swivel bar is pivoted on the guide bar with one end graduated in degrees and the other in taper per foot. The compound rest gets its movement from the bottom slide extension which has a bearing on the cross slide dovetail. By means of a locking handle, the bottom slide extension is locked to the swivel bar, thus causing the tool to turn the taper for which the swivel bar is set.

"Hisey" 10 and 15 H. P. Heavy Duty Buffing and Polishing Machine

The Hisey-Wolf Machine Co., Cincinnati, Ohio, has brought out a heavy duty



"Hisey" H. D. Buffing and Polishing Machine

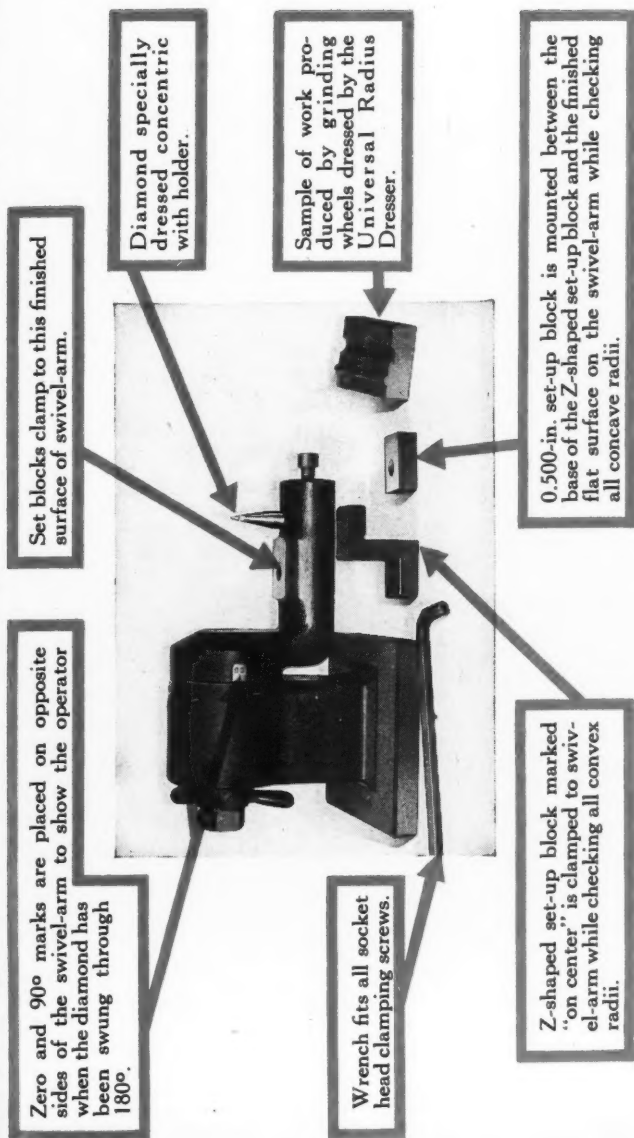
buffing and polishing machine that can be used with either a 10 h.p. or 15 h.p. motor, as required. The design includes unit spindle head construction, the spindle being 82 in. in length overall and projecting 15 in. at each end. The motor, which is ball-bearing equipped, is mounted horizontally on a dovetailed sliding base and is adjustable by means of a hand wheel and feed screw. Thus the proper belt tension is easily maintained, together with accurate alignment. This method of mounting the motor has been adopted in preference to the three-point suspension or tilting base.

The spindle head is mounted on four ball bearings, although Timken Tapered Roller Bearings can be supplied without extra charge. The bearing boxes are keyed to the column, a key along the entire base of the bearing housing insuring perfect and permanent alignment. The wheel arbor ends are finished with flat-top threads, which are intended to afford the maximum of security in holding the buffing wheel. A Tobin Bronze safety nut protects the thread and the operator. Easy access to the motor and motor starter is afforded by a large door in the column. The Flex-Steel conduit and fittings meet all requirements of underwriters.

Wicaco Internal Precision Grinder

The Wicaco Machine Corporation, Wayne Junction, Philadelphia, Penn., is

Announcing the NEW UNIVERSAL RADIUS DRESSER



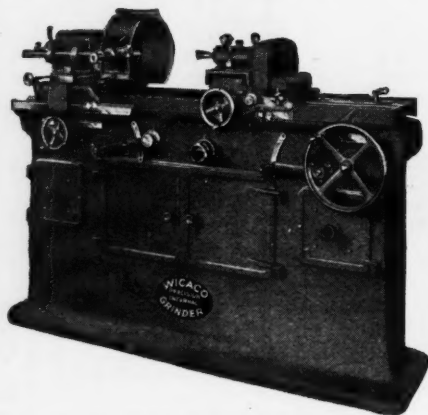
THE new Universal Radius Dresser was developed for dressing surface grinding wheels either convex or concave for grinding all sectional dies, forming dies, form tools, punches, models, gages, etc., to various radii.

Send for descriptive circular or ask your dealer to show you this new tool.

All manufacturing plants, tool and die shops will find this device will save many shop hours by eliminating hand-fitting on tools and dies where different radii and clearance must be maintained.

UNIVERSAL TOOL & MACHINE CO., 14 St. Louis Ave., Dayton, Ohio

now marketing the internal grinding machine shown in the illustration. The machine is built to handle work up to 12 in. diameter inside the water guard, and will grind holes up to 10 in. deep. The carriage is reciprocated automatically, separate motors being provided for operating the wheelhead and carriage. The features of the machine consist in the sensitivity of the reciprocating mechanism and in the mechanism by which



Wicaco Internal Precision Grinder

the carriage is automatically reversed, should an obstruction come between the carriage and wheelhead, or should the wheel strike a shoulder or the end of a blind hole.

The machine is motor-driven and entirely self-contained, the motors being hung on doors in the bed where they are readily accessible. These motors drive the wheelhead and carriage from a position directly beneath them. This construction promotes accuracy by reducing vibration to the vanishing point, and prolongs the life of the machine. All drives are provided with constant-tension devices, and are self-adjusting. Motors start under full load and are protected against overload damage. They are also protected fully from moisture and grit.

The wheelhead is enclosed in a patented water jacket which makes it possible to operate the machine continuously without appreciable rise in temperature. The oil chamber and bearings are surrounded by a generous cooling jacket through which the ordinary grinding coolant is continuously pump-

ed. The wheelhead is mounted on the upper of two cross slides, the slide providing both automatic and hand cross feed. The lower slide is designed to permit a quick setting for taper, or a step-over where two or more diameters are required. The wheel feed is automatic at each end of the carriage travel, or will feed straight into the work without carriage travel if desired. The automatic feed can be raised by 0.0002 in. steps from 0 to 0.001 in. per stroke.

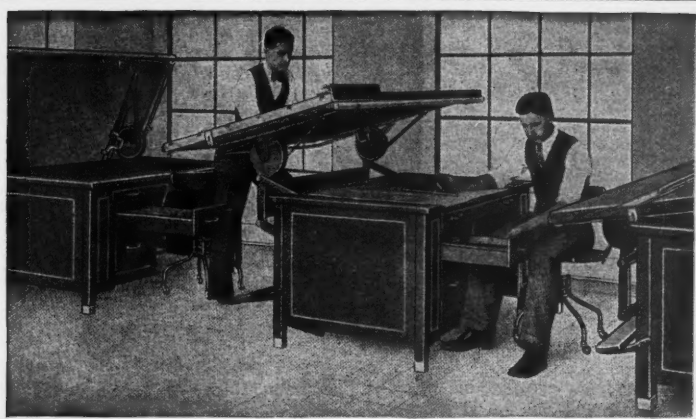
The carriage is driven by a variable speed motor with a rheostat control providing for 16 speed variations, and will traverse on 0.001 in. movement. Safety of operation is assured by the automatic reversing device for the traverse movement. Should any obstruction come between the moving carriage or its wheel and a fixed part of the machine, the carriage will automatically reverse. Thus the wheel can be fed in automatically to a shoulder or the bottom of a hole and the carriage will reverse when the obstruction is reached. The advantages of this feature can be readily seen. Necks for wheel clearance can be eliminated and shoulders can be accurately gauged by the carriage stops, which are graduated to 0.001 in.

All revolving parts of the machine are corrected for dynamic balance. The diamond wheel-truer is easily adjusted and operated. The pump and tank are integral, mounted on the back face of the bed. Sixteen traverse speeds are provided, from 20 in. to 60 in. per minute. Length of carriage ways, 35 in. Hole in spindle, 1½ in. Workhead graduated to 15 deg. Floor space required, 78 x 29 in. Weight, 2,400 pounds.

Reinecker Type 6N Worm Gear Hobbing Machine

A heavy duty hobbing machine especially designed for cutting heavy pitch worm gears, particularly those of the multiple thread type with long lead, has been placed on the market by the George Scherr Company, 142 Liberty St., New York, N. Y., representatives of J. E. Reinecker, Chemnitz. The outstanding feature of the machine is that worm gears may be cut by either of two methods—either by feeding the hob radially into the gear blank until the correct depth has been reached, or by employing the cross feed and tangential feed motion, in which case a short hob, preferably tapered, is fed axially past the

THE AUTO-SHIFT



DRAWING AND REFERENCE TABLE

THIS new table is practically automatic in all its adjustments. Any position of top obtained in five seconds. A handsome, steel desk mounted with a super-adjustable, full-floating, counter-balanced drawing board which is equip-

ped with a tool holder for vertical work and a built-in pencil ledge at the front.

The large desk-reference-surface, reference drawer and tool drawer provide ample working facilities. Use the coupon.

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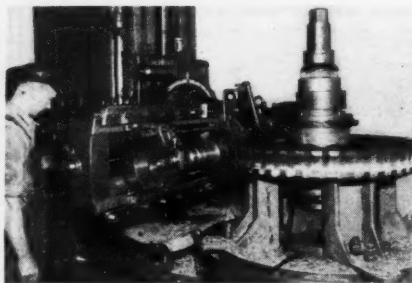
HAMILTON MFG. CO., Two Rivers, Wis.

Name

Address

City State

work. The latter can be used when the work is in small lots or when time is a factor, making it unnecessary to purchase expensive hobs, as a simple single



Reinecker Worm Gear Hobbing Machine
Set Up With Fly Cutter

tooth fly cutter will produce equally accurate results.

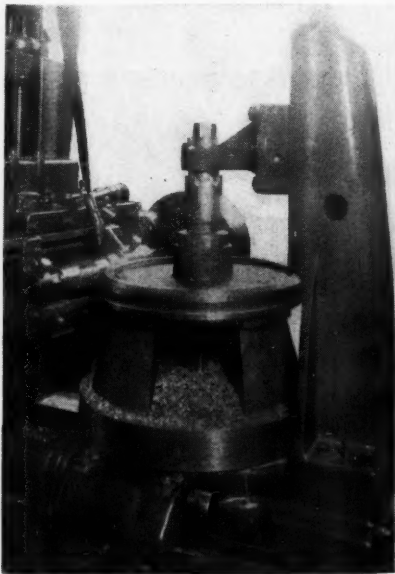
With the demand for more efficient worm drives, the use of small diameter worms with multiple thread and great helix angle has steadily increased, and it is for this class of work that the Reinecker machine is especially adapted. With the tangential feed, a theoretically correct and accurate worm gear with smooth flanks is produced which cannot be excelled in cases where high leads, great angles, and wide faces are concerned. The exact distance at which the wheel and worm are to operate is set by means of a scale and dial graduated to thousandths of an inch. At the start, the hob or fly cutter is at one side of the worm wheel blank. While the hob and gear operate in a combined rotary motion, the hob (or fly cutter) is fed into the blank in the direction of its axis. The axial feed toward the wheel necessitates that in addition to the combined rotary motion, still a second motion is imparted to the blank, this motion being obtained by a differential change gear mechanism which connects the index gears with the feed. The index change gear, feed gears, and differential gears are entirely independent, so that there is no necessity for tedious calculations.

The feed is controlled through a quick change gear box on the side of the machine, three lever positions and two pick off gears providing 24 different feed changes from 0.006 in. to 0.327 in. The index change gears which control the number of teeth to be cut are on the rear of the machine. Tables furnished with

the machine provide all information as to gearing, and the setting up process is extremely simple.

An important advantage offered by the tangential feed method is the possibility of using fly cutters instead of hobs. In cutting worm gears, in order to obtain full tooth contact between the gear and the worm, it is necessary to have a hob which is the exact duplicate of the worm, plus clearance added to the diameter. The expense for cutters can be reduced greatly by the use of simple fly cutters which can quickly be made up. The illustration shows a number of fly cutters for single and multiple thread worm gear jobs, together with the arbors in which these cutters are used. The production time when using fly cutters is quite satisfactory, and by no means as slow as is assumed by those who have had no experience with this method.

The machine is driven by a 15 h.p.



Reinecker Hobber Set Up With
Hob of Correct Diameter

constant speed motor with gear box arranged at the bottom of the housing. Eighteen cutter speeds, from 15 to 101 r.p.m., may be obtained. The speed and feed gears are hardened and ground on the flanks for smooth running. A

HAVE YOU ANY TOUGH DRILLING

In the 1/4-in. to No. 60 Range?

It doesn't matter what the job is — steel, brass, bronze, cast iron, carbon steel, nickel steel, chrome nickel, chrome molybdenum, chrome tungsten, chrome vanadium, stainless steels—in fact, all the difficult ones—that's where



BLUE DIAMOND HIGH SPEED DRILLS

demonstrate in no uncertain manner their superiority over ordinary high speed drills.

Don't mistake these drills for "just another drill"—they are designed and made to meet new conditions resulting from the use of new and harder alloys.

Check-up your small drill jobs now and let Blue Diamonds show you what drills of advanced design can do. Order a few today for test.

Furnished in Jobbers' Sizes 1/16 to 1/4-in. and Wire Sizes to No. 60.

Ask your local distributor for Blue Diamond High Speed Drills—in the Yellow Package.

Note:—If you want performance figures—ASK US, we'll give them to you.

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Manufacturers of
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CANADIAN DETROIT TWIST DRILL
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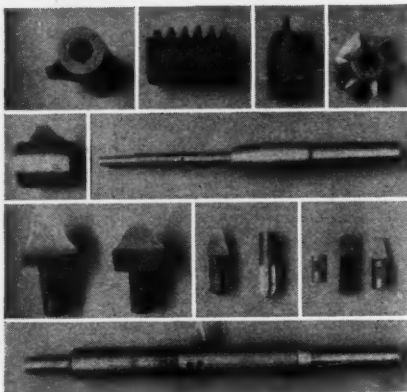
New York

DETROIT

Chicago

MAKERS OF FINE TOOLS FOR 77 YEARS

separate 5 h.p. motor is provided for adjustment of the upright in or out, rapid traverse of the cutterhead up or down, and for rapid return of the tangential feed slide. The cutterhead may be swivelled so that spur gears as well as spiral gears up to 25 deg. angle may



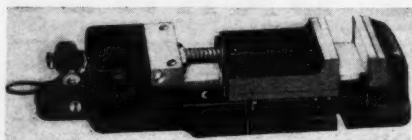
Types of Fly Cutters Used With Reinecker Hobber

be cut, also worm gears with the worm axis inclined 25 deg. to the wheel plane. A pump and $\frac{1}{2}$ h.p. motor provide lubrication.

The specifications for the 6N machine are as follows: Maximum diameter of spur, worm and spiral gears, $90\frac{1}{2}$ in. Maximum face, $23\frac{1}{2}$ in. Pitch capacity, $2\frac{1}{2}$ C.P. Max. dia. of hob, $13\frac{1}{4}$ in. Min. and max. center distances, $3\frac{1}{2}$ —50 in. Dia. of table, $52\frac{3}{4}$ in. Dia. of bore in table, $7\frac{1}{2}$ in. Dia. of dividing wheel, 48 in. Dia. of work arbor, 3 in. Dia. of hob arbors, $1\frac{1}{4}$, $1\frac{1}{2}$, 2 in. H.P. required, 15—5. Net wt., 31,000 pounds.

Hopkins Air-Operated Milling Machine Vise

The Tomkins-Johnson Company, Jackson, Michigan, has brought out an air-operated vise especially designed for use



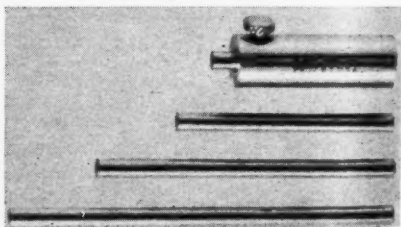
"Hopkins" Air-Operated Milling Machine Vise

on milling machines. The design incorporates the advantages of fast operation, which is the feature of the air-operated vise, with the low construction of the hand vise. The vise is low enough to allow the cutters to pass over it, and chatter is reduced to the minimum. The jaws, which are of hardened steel, can be removed to allow the use of special jaws especially suited to the work. Slots are provided for clamping and a key is provided in the base to fit into the milling machine table slots, insuring alignment.

The jaws are $6\frac{1}{4}$ in. wide by $1\frac{1}{4}$ in. high, and the maximum distance between the jaws is 4 in. The extreme height of the vise is $5\frac{1}{4}$ in.; the length of the base is $24\frac{1}{2}$ in. and the width is 7 in. The power stroke of the jaw is $\frac{1}{2}$ in.

B. & S. No. 599 Depth Gage

The illustration shows the No. 599 Depth Gage that has been developed by the Brown & Sharpe Mfg. Co., Providence, R. I., for checking the depths of holes, counterbores, and dimensions between shoulders and flanges. It can also be used for making many other measurements for which a small depth gage is required and has the advantage of being adaptable for use against or



B. & S. No. 599 Depth Gage

between very small shoulders or in shallow recesses.

Depths from 0 to 2 in. by thousandths of an inch are obtained by measuring the overall length of the body and rod with a micrometer and then subtracting the length of the body, which is exactly 1 in. The rods are polished and the body is hardened and ground. A V-groove facilitates measuring against a curved surface. The setting can be securely locked by the clamp screw. If desired, the tool can be used to measure distances from 1 in. to 3 in. between

Profit Sharing IS Fine if



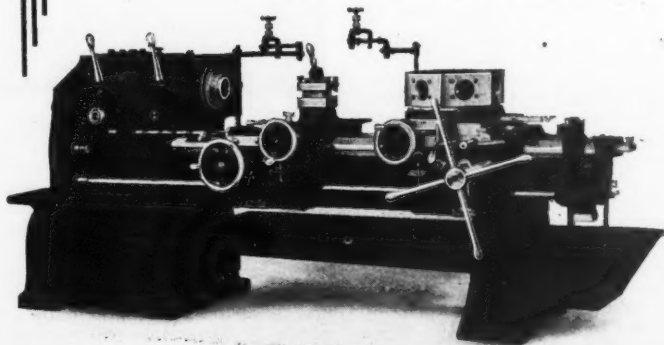
Cincinnati-Acme Universal Turret lathes are built in three sizes. Illustration shows the No. 1 size with 2½-inch capacity.



. . . . you don't have to share your profits with obsolete equipment! And, there is nothing takes a bigger bite out of your profits than old, slow, obsolete turret lathes!

That is one reason why you should replace these old machines with the New CINCINNATI-ACME Universal Turret Lathe. Its higher operating speeds and improved design assure you increased production, lowered costs and—above all—an improvement in the quality of your work.

Let us show you what you can save with this modern turret lathe. Write for bulletins!



THE ACME MACHINE TOOL CO.
CINCINNATI, OHIO

shoulders, the micrometer reading of the overall length of the tool being the correct dimension.

Potter & Johnson "Ekonomatic" Nut Machine

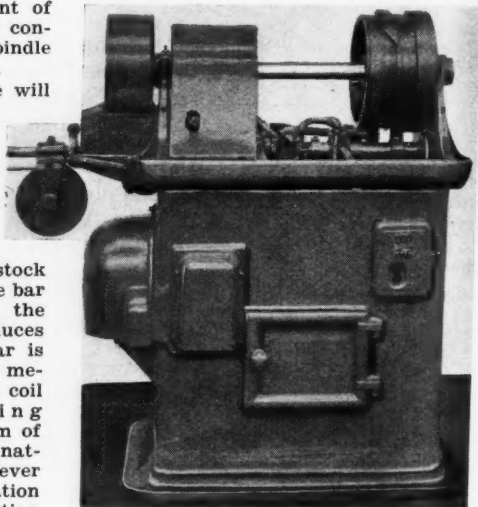
The Potter & Johnson Machine Co., Pawtucket, R. I., has brought out a machine which is capable of performing a variety of operations on bar stock, but which is particularly adapted to the production of nuts. The machine is said to be of extremely simple construction, and economical both in the amount of floor space required and in power consumption. It is of the single spindle type, without indexing mechanism.

The main spindle of the machine will handle hexagon bars up to $\frac{3}{8}$ in. across the flats for $\frac{1}{2}$ -in. hexagon nuts and 1-in. round stock. Due to simplicity of design, reducing internal friction to a minimum, the 2 h.p. motor installed in the base is ample for all requirements. The use of a $\frac{1}{16}$ -in. wide cut-off tool and a stock feeding mechanism which carries the bar completely through the spindle to the gripping surface of the collet reduces wastage to the minimum. The bar is fed to the working position by a mechanism employing a long, heavy coil spring contained within the feeding cable pulley. The conventional form of feed stop is not used, thereby eliminating the time required to bring this lever in and out of position and the operation of the center tool bar and double action swing arm, which carries cutting off and forming tools, are closely timed to perfectly synchronize their feeding movements.

Directly over the spindle is a swing arm, mounted on the cam shaft, on which is mounted cams for engaging and disengaging the collet at the proper point in the cycle of machine operations. The collet is of the draw-back type, connected to the rear of the spindle by means of a tube on the end of which is mounted a collar. The pull-back of the collet is accomplished through the use of fingers. Instead of the conventional design of sliding spool, the fingers are compressed by an external wedge collar for operating the draw back, thereby eliminating the element

of centrifugal force in the disengagement of the collet. The casting which supports the spindle and feed mechanisms is designed to eliminate the effect of stress and strain of cutting operations on the tools.

Three cams only are required for the operation of the machine—one for the feed and return of the center tool bar, one for the operation of the double-action swing arm, and a simple permanent cam for the collet operation. The mounting of the drum is designed for convenience, if necessary to change the contour of the cams. Any required



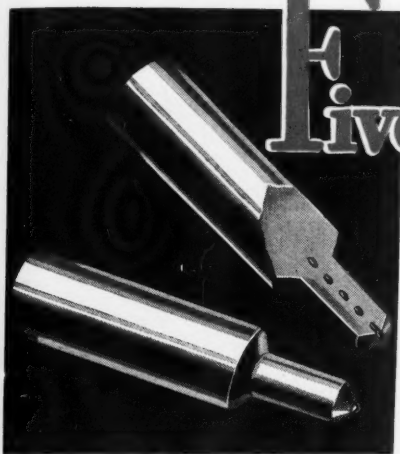
P & J "Ekonomatic" Nut Machine

spindle speed is obtained by changing the motor sprocket, from which the power is conveyed directly to the spindle by means of a silent chain. An adjustable idler compensates for the variation in chain length. As finished parts are cut off at the spindle nose, they drop into a strainer receptacle in the base, which is accessible through the main door. Provision is made for nine gallons of coolant, which is pumped to the spindle nose by a chain gear driven pump of ample capacity.

The nut capacity of the No. 1 machine is $\frac{1}{4}$ to $\frac{1}{2}$ in. bolt size of any type or standard. Length of machine, 4 ft. 2 in. Weight, net, 1,900 pounds.

The
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Five - In - Line

Mounting five diamonds
in one tool gives better
service at lower
costs



The sectional view shows the small diamonds mounted in line. KOEBEL Multi-Set Diamond tools are made in five-set, four-set, and three-set types in a range of standard sizes to meet every wheel-dressing requirement.



BEFORE you buy another diamond dresser with a single large diamond that must be continually reset—try a KOEBEL Multi-Set Diamond Dresser! You'll find it more efficient in all ways.

KOEBEL Multi-Set Diamond Dressers are radically different than other diamond dressers. They have several small, tested, quality diamonds mounted in one tool. After the first diamond is worn away in use, the metal is simply turned or ground off to expose the next stone.

And, there's no danger of losing the diamond from the mounting. The KOEBEL Method of entirely surrounding the stone with a newly developed metal holds the stone rigidly in place until it is entirely used up.

KOEBEL Multi-Set Tools cost less, eliminate resetting costs, reduce handling costs and lower losses from misuse to a minimum. Let us show you—write for a bulletin and price list.

KOEBEL

KOEBEL-WAGNER DIAMOND CORP.

144 Orange Street, Newark, N. J.

Detroit

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Cleveland

New York

Multi-Set Diamond Dressers

Ex-Cell-O Semi-Automatic Wire Wheel Finishing Machine

The illustration shows a semi-automatic machine that has been built by the Ex-Cell-O Aircraft & Tool Corporation, 1202 Oakman Blvd., Detroit, Michigan, to bore, form, and face wire wheels for automobiles. A wire wheel after the finishing operations have been performed is shown in the foreground. The machine operates as a semi-automatic for



Ex-Cell-O Semi-Automatic Wire Wheel Finishing Machine.

boring and turning two diameters, forming two peripheries, and facing the hub face on the wire wheel. The floor-to-floor cycle through which the wheel passes is as follows:

The wheel is placed on the rotating table of the machine and is centered by a shouldered pilot in the upper vertical unit. This unit is fed downward by means of a rapid traverse, controlled by the large hand-wheel at the top of the

machine, to an indicated stop where it is locked in position. The pilot is mounted on ball bearings and is backed by a heavy spring so that the required pressure can be exerted for holding the wheel in place. The stop consists of a roller which rides on the hub of the wheel, and enables the operator to set the cross slide, which is carried on the upper vertical unit, to remove the minimum amount of stock for truing the hub. With the upper vertical unit in this position, the feed is thrown in and the cross slide tool finishes the face hub and forms the radius on the periphery of the hub flange.

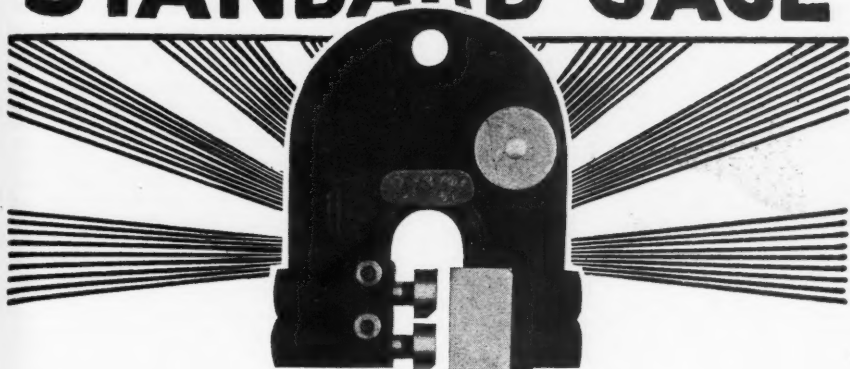
Simultaneously with this operation, the lower vertical unit is automatically fed up and bores the opposite end of the hub with a circular form tool. As the boring operation is completed, a roller comes in contact with the lower face of the hub and keeps the chamfering tool, which starts feeding horizontally at this point, true with the lower face of the hub. When the chamfer is completed, the lower unit comes to rest at the bottom of its stroke and the upper unit is released and fed upward to the end of its stroke, then the wheel is removed.

The entire machine is full ball bearing, and is driven by electrical motors contained in the base of the machine. The table is rotated by means of a spiral bevel gear. All controls are conveniently located and all working parts are enclosed. The production is from 65 to 70 wheels per hour.

Federal Dial Feed Mechanism

The Federal Press Co., Elkhart, Ind., has brought out a dial feeding mechanism for use on punch presses and similar equipment, in the design of which a new principle of indexing is embodied. It is said that the design eliminates some of the troubles that have been encountered in the past. The Federal dial is actuated from the crankshaft, as shown in the illustration, through two sets of bevel gears and a cam under the dial plate. This cam engages with hardened rollers attached to the bottom side of the dial, and every revolution of the crankshaft rotates the dial $1/12$ of a revolution, the same cam that actuates the movement of the dial plate also locking the dial positively in place and making it impossible for the dial to skid past the stop. This result is accomplished by having the indexing cam pass between the rollers on the bottom of the dial. No brakes, stops, or lock pawls

Another STANDARD GAGE



(ACTUAL SIZE)

For Gaging Small Parts

HERE is the new "Midget" Type STANDARD Adjustable Limit Snap Gage designed especially for gaging small parts such as slots, lengths, shoulders, diameters, etc.

The outstanding feature of this gage is the extreme light weight—coupled with maximum strength and durability. Combining lightness with strength assures you extreme accuracy, sensitiveness, speed and definite control where close gaging limits are required.

The "Midget" Snap Gage is made in four sizes ranging from 0 to $\frac{1}{2}$ " capacity. Weights range from two ounces for the small size to $3\frac{1}{2}$ ounces for the largest size.

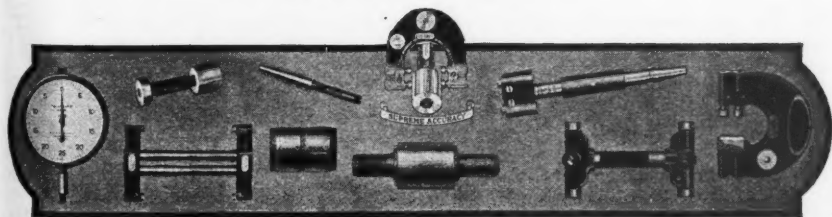
Investigate the advantages of the "Midget" on your product—how it will speed up your gaging and improve the accuracy of your work!

Send for a copy of the STANDARD Gage Catalog!

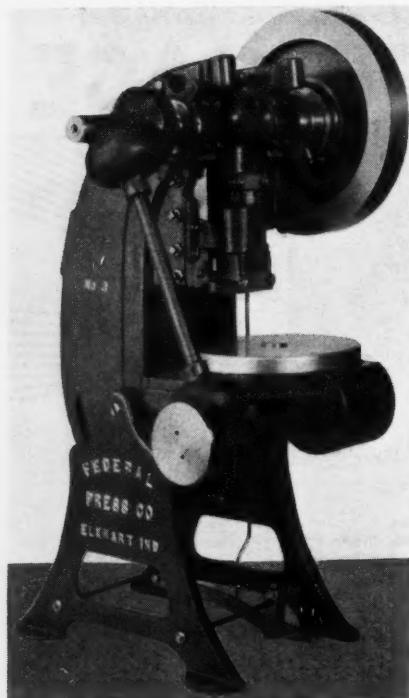
STANDARD GAGE CO.

INCORPORATED

POUGHKEEPSIE, N. Y.



are used. All moving parts are inclosed, the only moving part that is exposed being the dial itself.



Press Equipped With Federal Dial Mechanism

One of the most important features consists in that the dial movement is accomplished in less than a quarter of a revolution of the crankshaft. In fact, the complete indexing action is completed while the crankpin is passing through the top quarter of the stroke, while the ram is practically at a standstill. No extra kickout mechanism is necessary as the kickout is actuated from the cam shaft in the case beneath the dial. The mechanism can be mounted on any make of press.

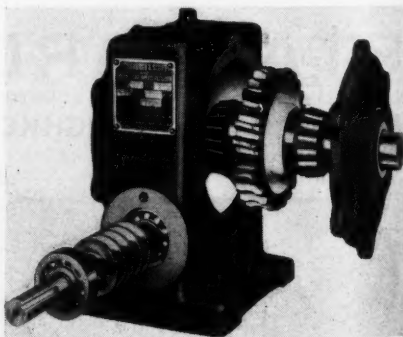
Horsburgh & Scott Small Reduction Unit

To meet the need for a reliable, economical speed reducer in the smaller sizes, The Horsburgh & Scott Company,

5110 Hamilton Ave., Cleveland, Ohio, has brought out the worm gear speed reducer shown in the illustration. This unit is made in two sizes, the WB600 and WB700. It consists of a worm and gear accurately mounted on suitable bearings and totally enclosed in oil-tight, dust-proof housings. The unit in either size is self-lubricating, of rugged construction, and occupies extremely small space.

The unit has four outstanding features. First, the worm is forged integral with the shaft, increasing rigidity by permitting larger diameters and insuring absolute concentricity of the worm. The worm can never become loose. Second, the worm threads are hardened to glass-hardness. The top, bottom and sides of the threads are accurately ground after hardening. Third, the face of the solid bronze worm gear is made extra wide to assure extra load-carrying capacity. There is no possibility of distortion when the gear is pressed onto the shaft. The gear is generated by a hob which is an exact duplicate of the worm, assuring perfect bearing surface. Fourth, perfect alignment of the worm and gear is provided by Gurney radial thrust bearings on the worm shaft and Timken bearings on the gear shaft.

The housing is a gray iron casting, made in one piece with the gear introduced through the side. Heavy external ribs are provided to resist distortion from unusual loads, the ribbing carrying the bearing loads to the base of the unit. The interior of the casting is entirely free from projections or pockets which might set up oil swirls in the reservoir, with consequent heating and loss of power. The housing is sand blasted in-

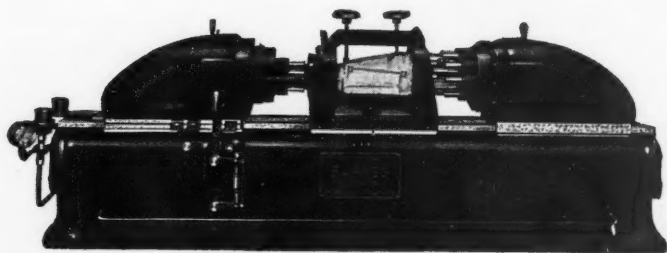
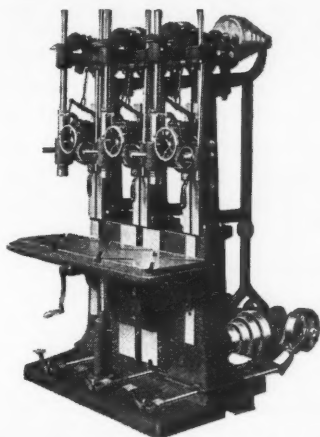


Horsburgh & Scott Small Reduction Unit

STANDARD & SPECIAL DRILLING & BORING MACHINES

A complete line of standard upright drilling machines—single spindle and gangs—stationary and sliding head—belt and motor drive—with or without attachments. 20-inch Sliding Head Gang illustrated at right.

Write for complete catalog



Special single - spindle or multiple-spindle machines, working from one direction or several directions simultaneously, with or without indexing table; for high production and heavy duty drilling, boring, reaming and similar operations.

Horizontal Duplex Multiple Spindle Drilling Machine illustrated above.

A SERVICE
WHICH GIVES HIGH
PRODUCTION
WITH LOW
MAINTENANCE
by

*Write for booklet
entitled
"Performance"*

W.F. and John Barnes Co.

ROCKFORD, ILLINOIS
Established 1872

side and out, and coated inside with an oil-resisting compound. The outside is coated with special hard-finish paint.

Lubrication is unusually thorough. The contact surface between the worm and the gear is always beneath the surface of the oil. The worm and gear bearings are also lubricated directly from this source. Large filler and drain plugs are provided, and an oil lever cock registers the correct oil level. The use of oil seals on both shafts, together with carefully-assembled gaskets, makes an oil-tight unit.

The units are designed to provide ratios of from $4\frac{1}{2}$ to 1 to 60 to 1, with worm shaft speeds of from 300 to 3,000 r.p.m. Horsepower ratings range from 5.4 downward.

Simplex Stockroom Bin Section

The Simplex Tool Co., Woonsocket, R. I., is now making a bin section especially for stockroom use, designed so that the sections can be built up like a sectional bookcase. This method of assembling the bins provides the utmost in convenience and, as the sections are not bolted together, they may easily be moved or rearranged at any time. Each section nests deeply into the other, and is of sufficient width and depth so that several, nested together, make a substantial unit. Their portability make them ideal for temporary stockrooms, or

top can be furnished to serve as a counter if desired, or as a shelf when large and small sections are assembled together. In such a case the larger sections are used below and the smaller sections above the counter.

Sections are made in four standard sizes, all 37 in. wide and with other dimensions as follows:

| Depth | Height | No. Bins | Width Bin |
|-----------------|----------------|----------|----------------|
| 12 | 4 | 6 | 6 in. |
| 15 | $5\frac{1}{4}$ | 5 | $7\frac{1}{4}$ |
| $18\frac{1}{4}$ | $6\frac{1}{2}$ | 4 | 9 |
| 20 | $9\frac{1}{2}$ | 3 | 12 |

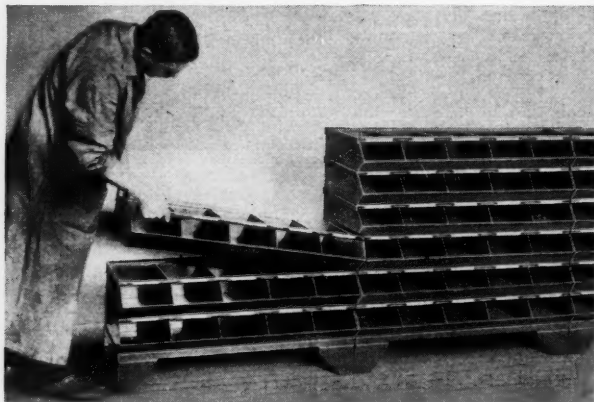
The widths of section bins can be changed to suit individual needs, and special size sections may be obtained if desired. Each bin has a cardholder for description of contents.

The sections are ruggedly constructed and unusually well made. Heavy gauge metal is used for the body and bin dividers, and band iron either $\frac{3}{8}$ or $\frac{1}{2}$ in. for the top band. Sharp edges that might catch the hand have been avoided, and the design of the bottom is such that the bins can easily be cleaned out. All sections are lacquered green.

Grant Model 4A Riveting Hammer

The No. 4A Riveting Hammer shown in the illustration has been added to the line of riveting hammers manufactured by the Grant Manufacturing & Machine Co., Bridgeport, Conn. This machine was designed to meet the demand for a machine to head rivets cold from $\frac{3}{8}$ in. to $\frac{1}{2}$ in. diameter. The machine is of the type known as a vibrating hammer, the hammer spindle being caused to vibrate between 1,500 and 1,800 blows per minute in a vertical direction. The heavier jobs require the higher speed.

The frame of the machine is a single casting and is designed to withstand the heavy vibrations of the riveting operation, and combines with curves and fillets to eliminate corners and recesses. The table has been made extra heavy in order to withstand the shock of the hammer-blows and properly



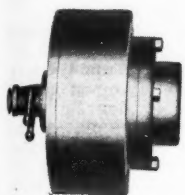
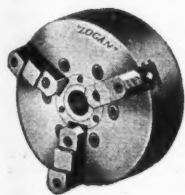
Simplex Stockroom Bin Section

for use where a certain amount of stock is carried on the assembly floor.

The base shown in the illustration is separate from the section itself, and a

with curves and fillets to eliminate corners and recesses. The table has been made extra heavy in order to withstand the shock of the hammer-blows and properly

BIRDS of a FEATHER....



THE best evidence as to the quality of a mechanical unit consists in the number of high-grade firms who are incorporating that unit in the manufacture of their own products. *And LOGAN Air Operated DEVICES are chosen by Industry's Leaders!*

The illustration shows a complete "LOGAN" Chucking Equipment consisting of Three - Jaw Chuck, Model "R" Double Acting Cylinder, Foot Control Valve, Exhaust Muffler, Reducing Valve and Automatic Lubricator adapted to a turret lathe.

You, too, can use "LOGAN" Devices on your product. Let us show you what they will save. Write for a catalog.



THE LOGANSPORT MACHINE CO., Logansport, Ind.

Designers and manufacturers of Air-operated devices for every work holding requirement as well as many other purposes.

support the work. The table is clamped to the frame by two heavy bolts and is also supported by an adjusting bracket which is keyed to the frame. An adjust-



Grant Model 4A Riveting Hammer

ing screw is used to raise the table. To prevent the adjusting screw from turning while the machine is in operation, a large locknut is provided which is tightened or loosened by the handle shown.

The riveting tool used on this machine is threaded to fit the outside diameter of the hammer spindle and is made from hexagon stock to permit the use of a wrench. The hammer spindle is rotated clockwise through a worm drive located inside the spindle arm. The worm shaft is driven by a V-belt connecting with the main shaft in the rear of the machine. The hammer spindle is made from a chrome-vanadium steel forging, heat treated.

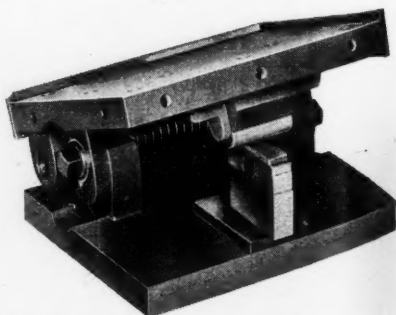
Seasoned hickory wood is used for the helve. The main shaft in the rear of the machine has at its center an eccentric bearing, which gives the connecting rod a reciprocating motion. The main pulley is made for a 1½-in. flat belt. The clutch is of the friction type with Raybestos lining, and thrust ball bearings

are used between the bronze nut on the mainshaft bearing bushing and the inner clutch plate. A brake is provided to stop the hammer spindle in its uppermost position, the brake being operated by the treadle rod. A light pressure only is required to operate the pedal. The machine requires a 2 h.p. 1750 r.p.m. motor, and will head a ½-in. diameter rivet in two seconds.

Krag Sine Angle Plate

Angle work in the tool room or other places where close limits are demanded can now be set up quickly and accurately by the use of the Krag Sine Angle Plate, manufactured by Franz K. Krag, 319 N. Albany Ave., Chicago, Ill. The angle plate employs a combination of the sine and gage block, and will reproduce any angle within one or two minutes.

The Krag Sine Angle Plate consists of two plates hinged together and so arranged that the top plate, upon which the work is held, may be clamped at any angle between 0 and 45 degrees with respect to the bottom or base plate. The base plate is provided with a hardened, ground and lapped anvil, centrally located at the rear; on the under side of the upper plate is a hardened, ground and lapped cylindrical surface. When the cylindrical surface is brought down into contact with the anvil, the working surface of the top plate is exactly parallel with the bottom of the base plate. As the top plate is tilted, the gap between the cylindrical surface and the anvil forms the sine of the angle.



Krag Sine Angle Plate, Showing How Angle Is Set By Use of Precision Gage Blocks.

Thus it is possible to obtain an exact angle, within a fraction of a thousandth of an inch, by the use of gage blocks.



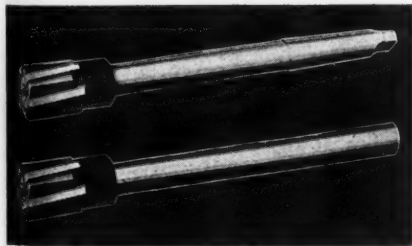
ADJUSTABLE REAMERS

The praise and respect of the men in the shop—those who use reamers daily and know their performance—is the greatest tribute. It is significant that Wetmore Adjustable Reamers have earned the preference of skilled craftsmen in every industry. Wetmore is known to them as "THE BETTER REAMER" from all standpoints—precision, finish, long life, economy. To you who buy reamers, what more convincing proof could there be than this endorsement of men who have used Wetmore Reamers for many years? . . . Send for latest catalog of all types of Wetmore Adjustable Machine and Cylinder Reamers and replacement blades.

WETMORE REAMER COMPANY

414 North 27th Street

Milwaukee, Wisconsin



WETMORE TYPE NO. 10 STANDARD REAMERS

Left-hand angle blades — high-speed steel, hardened and ground — insure free cutting at all times. Adjustments to .001 inch made rapidly and accurately. Micrometer adjusting screw is at front end of reamer body. Adjustable in less time than ordinary reamers. Over-size adjustment insures long life for each set of blades. Solid alloy steel body is heat-treated. Sizes range from 1" to 3" inclusive.

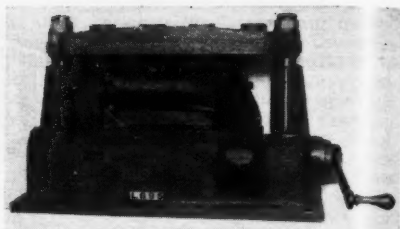
The dimension between the center of the shaft and the center of the cylindrical surface is exactly 3 inches, thus simplifying calculations.

No surface gage or height gage is required in setting the plate. When the plate has been set to the angle required, it is locked in position by tightening clamping screws at either end of the plate. A socket wrench is furnished for this purpose. The blocks are available in two models; the Model "S," which is of hardened steel throughout, and the Model "C," which is of cast iron with hardened and ground and lapped shaft and bushings. All working surfaces of the Model "S" are also hardened and accurately ground. A number of $\frac{1}{4}$ -in. holes in the upper plate provide for clamping, and all four sides of the upper plate are drilled horizontally to carry ground guide gages or gage plates, which are removable and adjustable. The blocks are $4\frac{1}{2}$ x 4 in., and are $\frac{1}{2}$ in. thick. A number of unique refinements are included to prevent wear and maintain precision.

The Krag Sine Angle Plate is furnished complete in a wooden case with a wrench and easily readable sine table giving, to five decimal places, the sines of all angles from 0 to 45 degrees in minutes.

Swartz Standard Drilling Fixtures

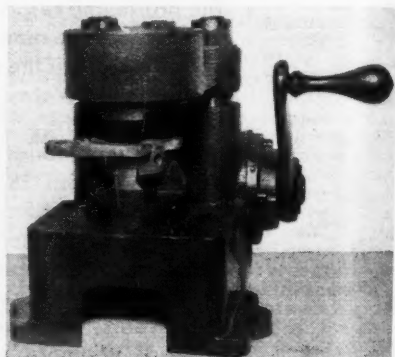
An improved line of Swartz standard drilling fixtures has been announced by the Geo. A. Gloor Co., 6440 Epworth Blvd., Detroit, Michigan. The fixtures are supplied in three types of open side, one end closed design, and in any size necessary to meet the requirements of the user. All fixtures are of two-post design, with large diameter posts to provide liberal bearing surfaces, and are intended to meet the demand for speed, durability and convenience in tooling. Flanged shoulders are provided to in-



"Swartz" L. H. Type Fixture Toolled to Drill Flanges of Exhaust Manifold.

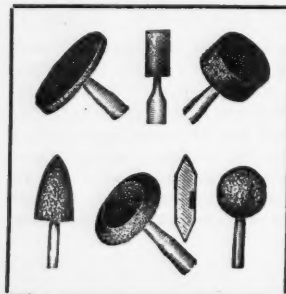
sure and maintain correct relation of fixture head to base, under the most severe clamping conditions.

The type "L" fixture is arranged for



"Swartz" L-Type Fixture Showing Special Head with Coolant Tray and a Plain Set of Adapters.

solid clamping, a draw rod being placed between the posts to operate the head to and from clamping position. A "Swartz" standard fixture lock holds



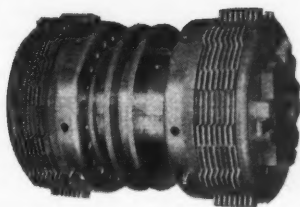
Mounted Grinding Wheels

For all small holes (open or blind), races, bushings, etc., and most any place hard-to-get-at; as on dies, tools, gears, etc. Hundreds of sizes, shapes, any shank.

CHICAGO WHEEL & MFG. CO.

406 East Woodbridge St.
DETROIT

110 South Aberdeen St.
CHICAGO



*Duplex Action
Close Coupled Type
Twin Disc Clutch*

EASIER CONTROL

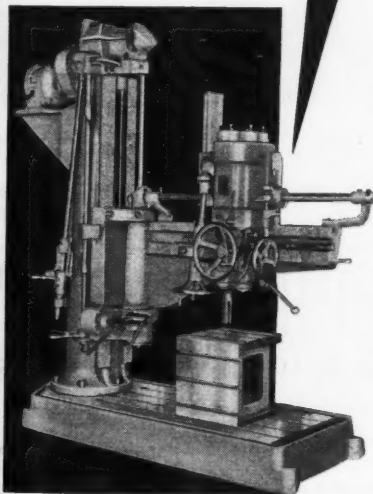
SPEEDS PRODUCTION

THE operator of a Western Low Hung Drive Radial Drill can concentrate on his work without being distracted by the manipulation of the controls. The entire control is in a single lever. With this Twin Disc Clutch equipped control, operation is remarkably easy . . . insuring speedier and greater production.

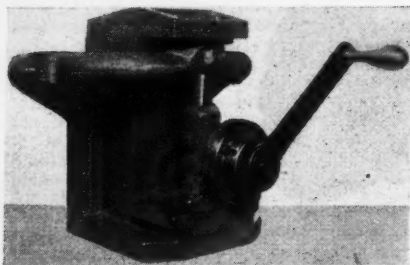
For greater efficiency and less upkeep, the engineers of the Western Machine Tool Works designed this drill with as few parts as possible. It was only natural for them to choose as standard equipment a clutch equally remarkable for its simplicity—the Close Coupled Twin Disc Clutch.

Its hub contains all the operating mechanism . . . centrifugal force operates to release pressure levers. Necessary lubrication is furnished by oil spray. The few adjustments needed are easy to make. Engagement and release are sure and smooth.

Compactness, capacity and all-around adaptability make it the preference of keen designers. There's a size and type for practically every machine tool need—2, 2½, 3, 3½, 4, 4½, 5, 5½, 6, 7 and 9 in. effective diameters; oil or dry plate, single or duplex. Write Engineering Research Dept. for specific recommendations. Engineering Data Book on request. **Twin Disc Clutch Company, 1326 Racine St., Racine, Wis.**



TWIN DISC
CLUTCHES



"Swartz" Standard Fixture Lock, Shown Clamping Intake Manifold.

the piece in position during the operation. The fixture head and operating lever will remain at any position desired by the operator, allowing the freedom of both hands for loading. Heads of different styles are supplied to suit the tooling to which the fixtures are adapted, and are interchangeable.

A flexible spring clamping line of fixtures—Type "S"—is provided for work which does not require the solid lock clamping feature of the "L" and "L.S." types, these fixtures being fast and easy of operation. A stop lug on the base serves as a stop for the operating lever, and when in this position, the head remains open, allowing the use of both hands for loading. Tripping of the operating lever away from this stop allows the fixture to chuck and flexibly hold the part under spring clamping tension during the operation.

A combination line of fixtures is also supplied, employing a standard fixture lock and spring mounted inside a case attached to the head operating shaft. This design provides a flexible or spring clamping means, as required for drop forged gear blanks and similar parts having no projections and which are located centrally and held against turn-

ing action of tools entirely within the lower fixture adapter.

The type "L.H." fixtures are intended for heavy work, such as exhaust or intake manifolds, or when any number up to six parts are to be handled in multiple. These fixtures are equipped with Swartz standard fixture locks for clamping, are sturdy in construction, and afford a maximum of adapter work surface relative to necessary table space.

Swartz Fixture Clamping Lock

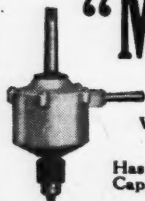
A fixture clamping lock which can be used on the type of tools and fixtures generally in use has been announced by



"Swartz" Standard Direct Drive Fixture with Operating Lever Attached.

the Geo. A. Gloor Co., 6440 Epworth Blvd., Detroit, Michigan. By drilling

"MAKES TAPPING EASY!"



The NEW "PROCUNIER" HIGH SPEED TAPPER

WITH "DOUBLE-CONE" CORK CLUTCH AND AUTOMATIC REVERSE

For High Speed Sensitive Tapping On Drill Presses

Has Ball Thrust Bearings, Balanced Reverse, Bronze Bushings.

Capacity. $\frac{1}{2}$ " Cast Iron. $\frac{7}{16}$ " Steel. Price only..... **\$45.00**

Let us send free trial details on this and our other styles and sizes.

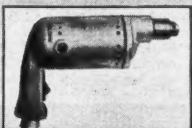
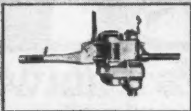
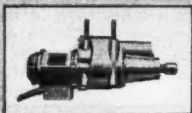
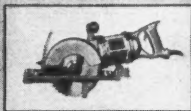
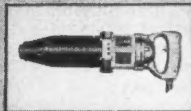
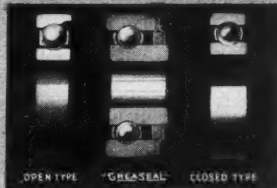
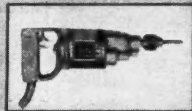
Procunier Safety Chuck Co., 12 So. Clinton St., Chicago, Ill.

SINCE 1918

USED IN



HIGH SPEED PORTABLE TOOLS



Black and Decker Mfg. Co. (Towson, Md.) produce a line of portable tools that is unrivaled in scope and in the diversity of duties it covers.

The extensive use of NORMA-HOFFMANN Precision Bearings in this comprehensive and diverse line, proves the wide range of adaptability for all duties afforded in the many types of PRECISION Bearings.

In Black and Decker tools, NORMA-HOFFMANN Bearings are carrying their loads at speeds ranging (according to location) from 200 R. P. M. to 14,000 R. P. M. They are used on chuck spindles, intermediate shafts, and motor shafts.

Wherever the worth of a tool or machine is measured by its service-ability, the use of NORMA-HOFFMANN Bearings will effect a definite and tangible betterment in its performance.

There is a PRECISION Bearing for every load, speed and duty. Our Catalogs will aid you in making selection. Write for them — or ask our engineers.

NORMA-HOFFMANN

PRECISION BEARINGS

BALL, ROLLER AND THRUST

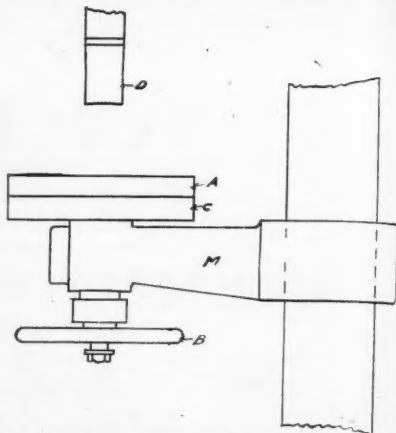
NORMA-HOFFMANN BEARINGS CORPN. - STAMFORD CONN. U.S.A.

and tapping three holes, the lock can be mounted at any desired position on the face of the fixture. The simple movement of a lever actuates the clamping mechanism, the pressure applied being delivered directly to the part to be clamped. All internal parts of the lock are hardened and ground. The first wear results in a general smoothing of the ground surfaces, and when the seating-in process is completed, the seat thus formed is permanent and will not be destroyed by further use.

Being of direct drive construction, a weighted lever or mallet may be used on the lever without damage to the locking parts. The driving member to which the operating lever is attached fits inside the outer case, providing a completely enclosed unit. The lock is extremely compact and easy to apply. The locks are made in three sizes. Full detail data for use is furnished.

Ortleb Indexing Drill Press Table

A drill press table that can be indexed to serve as an indexing fixture has been placed on the market by Douglas B. Ortleb, 2513 Baldwin St., St. Louis, Mo. The table is so constructed that the top table, shown as A in the illustration,



Ortleb Indexing Drill Press Table

can be revolved about a stud in the center of the drill press table, being locked at any one of a given number of definite points by means of an indexing plate. The table is loosened for indexing by the use of the wheel B. The top plate A can be made as a drill fixture and mounted on the table plate C, then the index plate can be set for a given number of holes. A number of jigs can

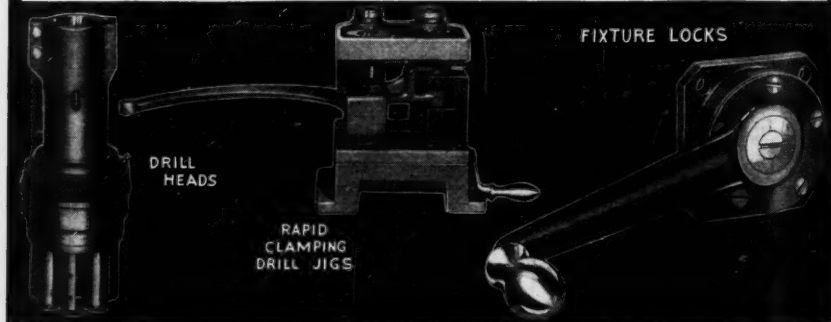
SIEWEK

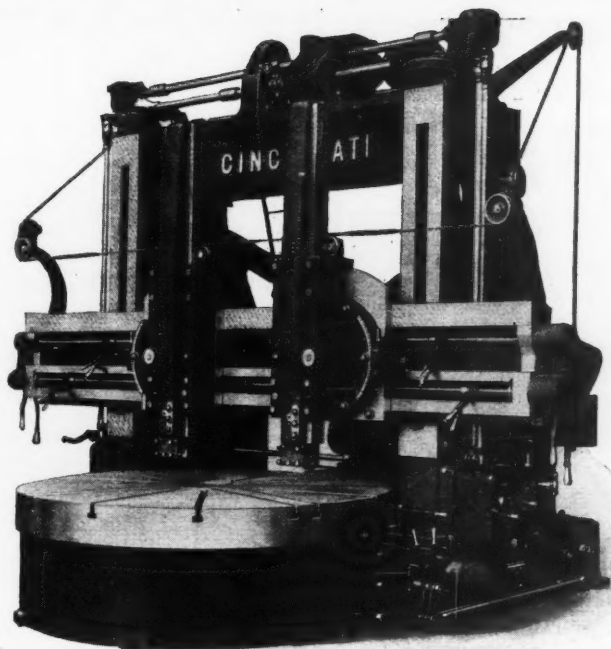
TEST SIEWEK TIME SAVING TOOLS

Higher production, lower costs! To attain these twin goals is the aim of every manufacturer. Siewek Rapid Drill Jigs, Drill Heads and Fixture Locks can help. Consider *Cushion Clamping* of Siewek Rapid Drill Jigs. Efficiency is promoted. Loading time is

decreased. Production is increased. This feature plus Siewek speed, accuracy and dependability reduces operating cost to a minimum. Try Siewek tools. Test their time saving ability. We'll make immediate delivery on standard sizes. Write for our new No. 3 Catalogue.

SIEWEK TOOL COMPANY
10232 Woodward Ave., Detroit, Mich.





A Modern Tool . . . The Cincinnati Boring Mill

ANY USER of the Cincinnati Boring Mill will tell you that it is a thoroughly modern tool. Incorporated in its design are modern features which improve your production and cut your costs. Some of these features are:

Centralized Control—All control levers are operated from one central position.

Rapid Power Traverse—Speeds up production without additional physical effort.

Feed Gear Box Mechanism—Is entirely independent for each head. There are eight feeds provided.

All Gears and Racks are of Steel—To insure long, dependable service and low maintenance costs.

Built in various sizes from 5 feet to 12 feet to meet all requirements.

SEND FOR BULLETIN

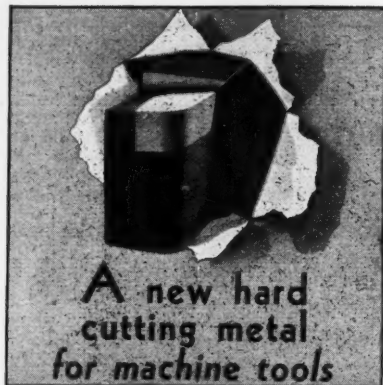
THE CINCINNATI PLANER COMPANY

3100 SOUTH STREET

CINCINNATI, OHIO



RAMET



YOU have never used a cutting metal like RAMET (Tantalum Carbide)—it's something *entirely new!* And in performance, RAMET is setting an entirely new pace.

RAMET has advantages found in no other tool metal. For instance, its low thermal conductivity *keeps tools cool*—even when chips are red hot!

Try RAMET on your job—whether it be “unmachineable” steel, or fast production work where seconds count.

Full information upon request.

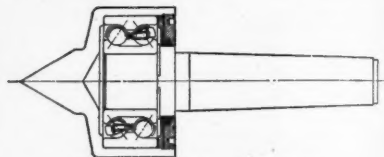
Fansteel Products Co., Inc.
North Chicago, Ill.



be used so that while one piece of work is in process of being drilled, the operator can be changing the work in the next jig. For odd-shaped castings the top plate can be made to accommodate the work. Vises can be mounted on the table instead of jigs, if desired. To install this table, it is necessary only to remove the present table and locate the Ortleb table on the arm; there are no holes to drill nor parts to be lined up.

Improved “Ready” Ball Bearing Center

The Ready Tool Company, of Bridgeport, Connecticut, is now furnishing its ball bearing live centers with a new and more efficient bearing closure. This closure is made in two parts: an inner piece, or washer, which contacts directly with the face of the pre-loaded



“Ready” Ball Bearing Center

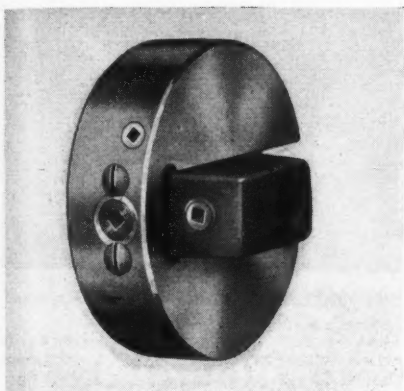
double row ball bearing, and an outer piece, or locknut, carrying the felt ring. By this arrangement, all of the threading is now done on the relatively thick outer piece and a stronger, more secure clamping effect is obtained.

Since permanence of bearing rigidity and accuracy depends upon the exclusion of abrasive dirt from the balls and races, an efficient closure is not only important, but its removal by users is not desirable. For this reason the set screw locking the clamp nut is covered with a flush soft metal seal and so long as this seal remains unbroken, the product is covered by the full guarantee of The Ready Tool Company.

No. 40 Flynn Micrometer Boring Head

J. M. Waterston, 420 Woodward Ave., Detroit, Michigan, has brought out a new size of Flynn Micrometer Boring Head for use on milling or boring machine work where it is necessary to have a large offset. The body of this tool, which is known as the No. 40, is 6 in. diameter by 1½ in. deep. The block

extends $1\frac{3}{8}$ in. and will provide an offset of 3 in. It is locked by a setscrew on the face of the body. The head will hold bars from $\frac{1}{2}$ in. to $\frac{1}{4}$ in. diameter. The boring bar is held in position by a lock screw which clamps the bar into



No. 40 Flynn Micrometer Boring Head

a Vee in a hardened steel block. The dial is graduated in thousandths of an inch.

The head is made of an excellent grade of steel, and the micrometer adjustment screw is of nickel steel, hardened and ground. The dial is graduated in thousandths of an inch for accurate adjustment in boring. The head can be furnished with any size and type of taper shank desired, or with blank shank. Every part of the tool is of the finest workmanship, and both accuracy and smoothness of operation are outstanding features.

"National" Draftsman's Pen-Filling Inkstand

A pen-filling inkstand which holds the standard $\frac{3}{4}$ -ounce India Ink bottle, known as the "National" Draftsman's Pen-Filling Inkstand, is now being marketed by the L. M. Prince Co., 108 W. Fourth St., Cincinnati, Ohio. The bottle is held in place by a blued steel spring clip, and all of the different makes of drawing ink bottles will fit the stand. The stand is equipped with a stub filler pen, held in a special holder which permits the filler pen to be placed

RAMET TIPPED TOOLS

for the machining
of all kinds of steel
and other materials

RAMET—a hard metal
(Tantalum Carbide) material that has proved practical in machining all kinds of steel and other materials.

Low heat conductivity prevents brazing from melting or becoming plastic and reduces to a minimum the danger of the RAMET Tip loosening or falling off.



*Catalog of
Standard RAMET Tools
sent on request*

ILLINOIS TOOL WORKS

2501 N. Keeler Ave. Chicago, Ill.

THEY SAY:

"We adopted the PULLMORE Clutch because of its compactness and efficiency. We have used several types of clutches, all of which were greater in size but none of which had greater gripping power."

A PRINTING PRESS Manufacturer.

"We are more than pleased with the service these PULLMORE Clutches have been giving us."

A CRANE Manufacturer.

"The PULLMORE is standing up under heavy use and abuse, as well as affording instantaneous control at all times."

A HEAVY DUTY LATHE Manufacturer.

"We have adopted your PULLMORE Clutches because they fit in with the type of construction and ruggedness which we endeavor to embody in all our machines."

A TESTING MACHINE Manufacturer.

The PULLMORE INDUSTRIAL CLUTCH



THESE few statements represent the outstanding features of the PULLMORE'S pulling capacity, efficient control and compactness. It is readily adaptable to a great variety of machinery, as indicated, creating improvements in the design and performance of such machines. The PULLMORE is made in Single and Double types for running dry or in an oil bath. Capacities range from 2 to 25 H.P., at 500 R.P.M., varying with the R.P.M.

Investigate the PULLMORE. Send in the coupon for complete Specification catalog, and let us make recommendations covering your requirements.

-----Send Coupon-----

Rockford Drilling Machine Co., Rockford, Ill.

Send me a copy of the PULLMORE Industrial CLUTCH Catalog.

Name _____ Title _____

Firm _____

Address _____

MMS-3

in any position around the holder. As the ink is used out of the bottle, the holder may be lowered so that it will pick up the proper amount of ink. A hole in the base provides a handy place to put the regular cork of the bottle so



"National" Draftsman's Pen-Filling Inkstand.

that it can be replaced in the bottle when changing to ink of a different color.

A soft, flexible rubber pad in the top, mounted against a brass swivel seat, will swivel into place and keep the bottle air tight and dust proof, regardless of the difference in the heights of the various makes of bottles. The weight of the top is sufficient to keep the bottle tightly sealed. The top will freely swing back and remain open so that a writing pen can be dipped into the bottle. The base, top, and ring are of gray cast iron, nicely painted in Ivory Duco or finished in a highly-polished nickel plate, and the bottom is finished so that it can be set on the drawing board close to the work. The stand is large and heavy enough to prevent accidental tipping. It is always ready, and never splashes. The opening ring can be operated either from the front or side.

GEARS

Speed
Reducers
V-Belt Drives

Send for Catalog
Eberhardt-Denver Gear Works
1408 W. Colfax Denver, Colorado

KELL
84 FR

POLDI TOOL STEELS

LOWER COSTS! INCREASED PRODUCTION!

Results obtained when you specify POLDI TOOL STEELS

POLDI STABIL

Free machining, non-deforming, oil hardening die steel.

POLDI 2002

Non-abrasive, hard wearing, for maximum production.

POLDI TENAX

Strong, tough, wear resisting for heavy duty tools.

These are but three of POLDI TOOL STEEL brands. The full line consists of the finest grades of High Speed and Tool Steels. Prompt delivery from our warehouse stocks.

*Write For Bulletins and Information On Our
Free Consulting Service!*

Poldi Steel Corporation of America

247 W. 18th St., New York

1627 W. Austin Ave., Chicago

Representatives in BOSTON, HARTFORD, STAMFORD, PHILADELPHIA, CLEVELAND

THE KELLERFLEX



The Kellerflex Machine with low roller floor stand has four speeds which provide for operating various tools at their correct speed. The whole driving unit switches freely both horizontally and vertically, adjusting itself instantly to the position in which the end piece is held, thus causing the least possible bend in the shaft.

This feature reduces the strain on the cable and also saves any loss of power from friction due to driving a shaft through sharp curves.

Let us send you our catalog and recommendations both for machine and attachments as adapted to your individual needs.

KELLER MECHANICAL ENGINEERING CORPORATION
84 FRONT STREET

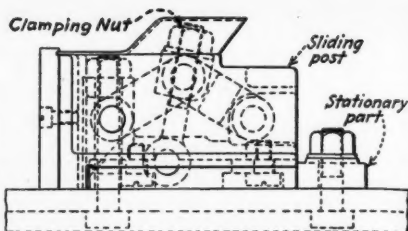
BROOKLYN, N. Y.

Complete stock at Chicago and Brooklyn

KME

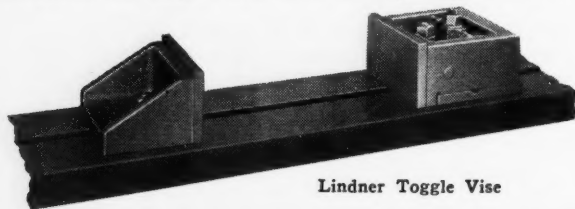
Lindner Toggle Vise

The illustration shows a toggle vise that is being manufactured by The Lindner Manufacturing Co., Wyoming and Forrer Sts., Lockland, Ohio. The vise is intended for machine use and is made in sizes from 4 in. wide to 20 in. wide, the latter size being adaptable for planer use. The jaw heights range from 3½ to 6 in. One jaw is stationary, the other containing the toggle mechanism. The toggle jaw can be anchored at any desired point. The moveable jaw is clamped against the work by the movement of screwing down a nut which expands the mechanism of the joint, one arm section of which is attached to the moveable jaw. The vise is especially adaptable for large work, or in a shop



Mechanism of Moveable Jaw, Showing Action of Toggle

where a variety of work is handled. Standard sizes for general use are 4 x 3 in., 6 x 3½ in., and 8 x 4 in.



Lindner Toggle Vise

Landmaco Threading Machine

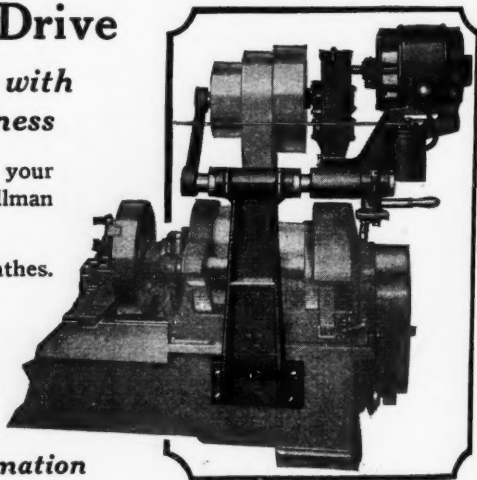
The Landmaco Threading Machine which was described in the February issue of this magazine is the same machine as that referred to in the advertisement on Page 2 of this issue.

Cullman Lathe Drive

A Motor Drive Unit with Belt Drive Smoothness

MOTORIZE and modernize your cone pulley lathes with Cullman Lathe Drives.

Quickly and easily attached to lathes. Only four bolt holes needed. Made in 1, 2, 3 and 5 h.p. sizes for lathes from 14" to 36". Also made for Shapers and Milling Machines.



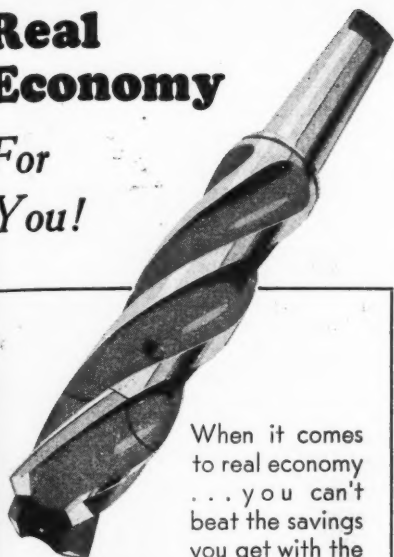
Send for Information

SPROCKETS - SPEED REDUCERS - LATHE DRIVES

CULLMAN WHEEL CO., 1336 Altgeld St., Chicago, Ill.

Real Economy

For
You!



When it comes to real economy . . . you can't beat the savings you get with the

Midwest Core Drill . . . especially where accurate drilling is required.

This tool consists of a holder and core drill tip, so arranged that after the tip is worn out a new tip may be inserted without removing the holder from the machine.

Midwest Core Drills eliminate the necessity of replacing complete solid high speed core drills which are very expensive because they go undersize so quickly.

Write for a bulletin . . . it describes many more economy features of this tool.

MIDWEST TOOL & MFG. CO.

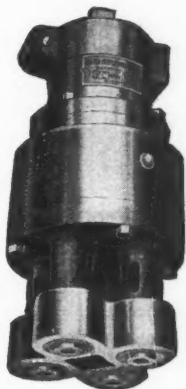
Division of McCroskey Tool Corp.

2362 W. JEFFERSON STREET
DETROIT :: MICHIGAN

Speed Up

DRILLING OPERATIONS

with a



U.S. Drill Head

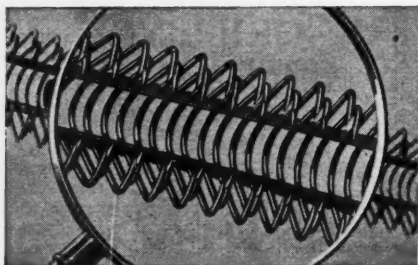
WITH this simple attachment on your one-hole-at-a-time drilling machine, you can drill two, six, a dozen, or fifty holes, if necessary, in the same time it takes to drill one.

The drill head shown above is a single purpose tool for drilling four holes at one time. It is a fixed spindle multiple head, but we also make adjustable spindle multiple heads, which can be used on a variety of jobs. What is your problem? We will design a U. S. Multiple Drill Head to meet your particular needs. Send us your blue print NOW.

The United States Drill Head Co.

1954 Riverside Drive
CINCINNATI, O., U. S. A.

SAFETY



TWO small, flat, steel binder bars are firmly swedged to each hook and run the entire length of the strip.

To use Safety Belt Hooks cut the two binder bars the desired length for the belt to be laced. Special nippers are in each box. Then lace the belt in the customary manner.

When laced, the binder bars remain firmly fixed to every hook so that each hook must stay in its exact position and stand its pull and equal share of wear and strain.

Safety Belt Hooks stop belt hook accidents because there can be no loose hooks to injure hands.

All strips are twelve inches long (84 hooks). Twelve strips, six high-quality rawhide pins and a special nipper to cut the binder bars, in each box.

Write for sample strip and give your jobber's name.

SAFETY BELT-LACER COMPANY
Section I., Factories Bldg.,
TOLEDO, OHIO

BELT HOOKS

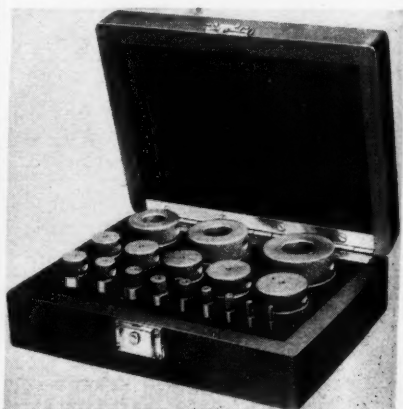
P & W Stub Gages for Precision Boring

The Pratt & Whitney Company, Hartford, Conn., has brought out a stub gage especially for use in precision boring operations or other similar use where the clearance between the tool and the work is short. In most precision boring machines the vertical travel of the tool is obtained by a quill, while the head itself remains clamped in one position, thus avoiding errors that might develop if the head were moved to provide gaging clearance below the tool. With the P & W stub gage this difficulty is overcome.

The gage is made with the usual cylindrical gaging surface, but a short knurled finger grip is substituted for the handle. The larger sizes are hollow for lightness, and a hole through the finger grip permits



P & W Stub Gage
In Use



Set of P & W Stub Gages in Case

TWENTIETH CENTURY BALANCING TOOL



*Always
on
the
level*

The most practical, sensitive and inexpensive device manufactured for balancing pulleys, cones, armatures, fly wheels, polishing wheels, etc. Will set anywhere and is easily portable. In sizes up to 24,000 pounds capacity.

Ask for the Bulletin

Sundstrand Machine Tool Co.
ROCKFORD, ILL.



Pat. Exceptionally Strong SELF-OILING

Apex Universal Joints are simple in design, made of special alloy steel and heat-treated. Made to specifications.

Let Us Quote On Your Requirements

The APEX MACHINE COMPANY
DAYTON, OHIO



Speed
Up assembling operations with APEX Universal Joint Socket Wrenches in difficult places. Set nuts or bolts in one operation.

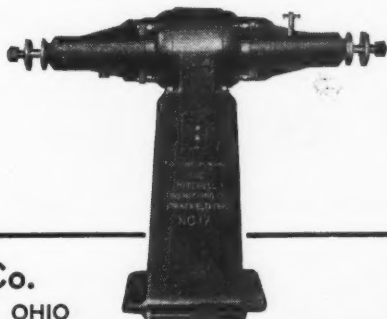
Quiet...

Noise is your greatest enemy. It wears out your workmen and slows up production!

That is one advantage of this MITCHELL Polishing Machine. The herringbone gear drive makes it practically noiseless in operation.

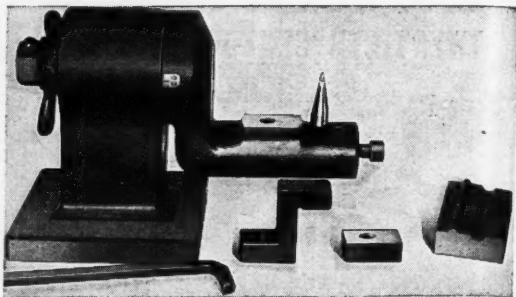
Besides, this drive delivers 98 per cent of the motor power to the spindle, enables you to obtain any

spindle speed from 1,800 to 3,000 r.p.m., and retains all the benefits of a direct motor drive. Let us show you. Write for a bulletin!



The Mitchell Engineering Co.
SPRINGFIELD OHIO

the insertion of a pin when necessary. The gage is made of alloy tool steel and is heat treated to obtain the requisite gage hardness and toughness. The gaging surface is machine-lapped to size. The gages are available either singly or in sets of 17 in a wood case. Sizes are $\frac{1}{16}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, 1, $1\frac{1}{8}$, $1\frac{1}{4}$, $1\frac{1}{2}$, $1\frac{3}{4}$, and 2 inch.



Universal Radius Dresser and Accessories

Model "O"

Universal Radius Dresser

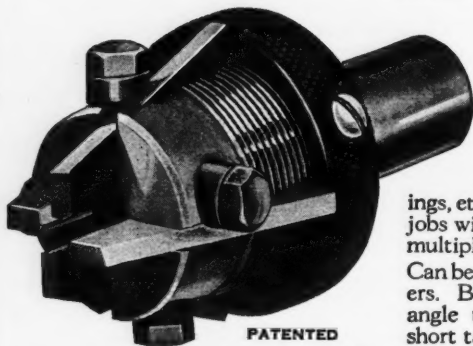
Surface grinding wheels can easily be ground concave or convex, for grinding radii in dies and other work, by the use of the Universal Radius Dresser now being made by the Universal Tool & Machine Co., 14 St. Louis Ave., Dayton, Ohio. The device is intended to eliminate hand-fitting on tools and dies where different radii and clearance must be maintained.

The tool consists of a cast iron base

and column, supporting a swivel arm which carries a diamond for dressing the wheel. The swivel arm is of steel, and that part of it which serves as the shaft is hardened and ground to a perfect fit in the bearings, with ample thrust surfaces at either end. The bearings are housed so that they are practically dust-proof and all grinding dust passes in a horizontal path away from the bearings. Both sides of the base are machined parallel to the shaft, providing convenience in using the tool on

Genesee Adjustable Hollow Mill

Made in 7 different styles



Has adjustable, replaceable blades and can be replaced at nominal cost, making it unnecessary to continually buy new tools.

The ideal tool for finishing your forgings, castings, etc. Do your several operation jobs with Genesee inserted blades multiple operation tools.

Can be fitted with drills and reamers. Blades can be ground any angle to point work and turn short tapers.

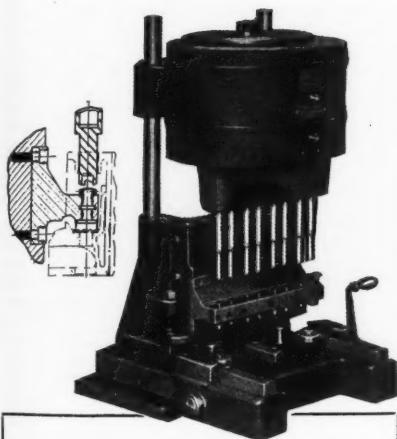
A Genesee Adjustable Hollow Mill can be made for every job

WRITE FOR CATALOGUE

GENESEE MANUFACTURING CO., Inc.

ROCHESTER, NEW YORK

Unusual? Hobs —



Not for a SNYDER Set-Up!

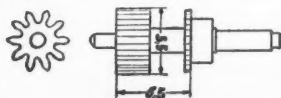
THIS SNYDER Set-Up solved a hard problem of back spotfacing the valve spring seats of a cylinder block.

Notice how the cutters are mounted to a slide on the fixture. The work is loaded into the fixture, the cutters entering the valve spring chamber of block. The spindles enter through the push rod guide holes and engage the clutch drives on each spindle.

Here is demonstrated SNYDER ability to solve unusual problems. Let us show you what can be done on your work. Just send blue prints or samples.

SNYDER TOOL & ENGINEERING CO.

3400 East Lafayette Avenue
DETROIT, MICHIGAN



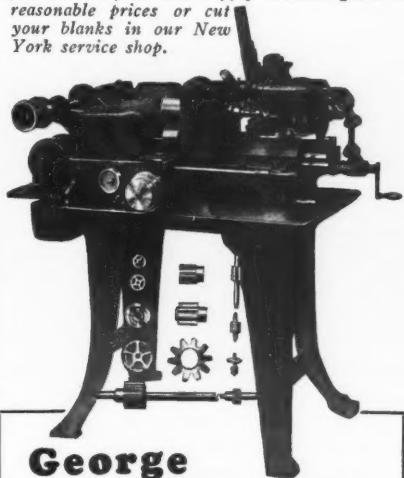
153 Nickel Pinions Every Hour!

SHOWN above is a drawing of a $\frac{1}{4}$ " diameter Nickel Pinion which is being hobbled on a KOEPFER Automatic Hobbing Machine at the rate of 153 per hour . . . and every pinion is extremely accurate.

Such accurate results are assured by the hobbing process which generates a theoretically correct tooth form. The high production is assured by the magazine feed which eliminates all non-productive loading time.

You, too, can obtain equally as good results in your shop. Let us show you. Write for catalog WMI.

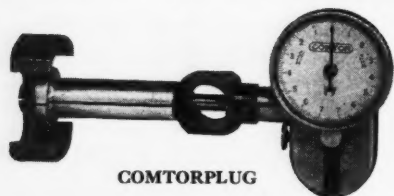
If your requirements do not justify installation of a machine, we can supply finished gears at reasonable prices or cut your blanks in our New York service shop.



George SCHERR CO.

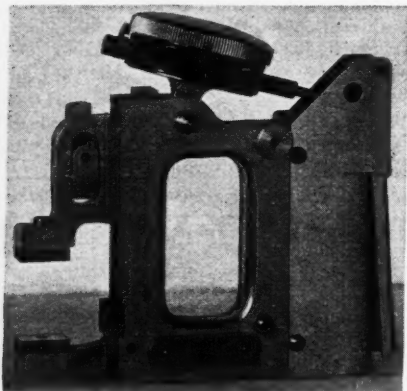
142 Liberty St., New York, N. Y.

COMTOR



COMTORPLUG

Comtorized Products are of the highest precision because all gaging errors, including expansion and wear, are completely eliminated, by fully automatic means.



COMTORGAGE

Comtorized Production is sure and rapid, because all Comtor instruments read, directly on their dials, the exact amount yet to finish. The work is brought to size, quickly and surely, with fewest passes, by measured feeds and size reductions. There is no blind guessing or trying.

Send for Descriptive Literature.

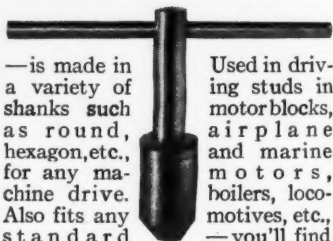
THE COMTOR COMPANY
WALTHAM, MASS.

a magnetic chuck with a straight edge. The swivel arm is revolved by means of a hand-wheel.

The Model "O" dresser has a range of 0.750 in. radius, either convex or concave, and will clear a 7-in. grinding wheel. The dresser pivots in a horizontal position so that the grinding wheel can be fed down to the diamond the exact amount of the radius to be dressed. Any radius can be dressed without removing the wheel guards.

A finished surface is provided on the swivel arm from which measurements can be taken for setting the diamond. A Z-shaped set-block is provided for setting the diamond exactly on center, and the diamond can be set accurately for dressing the wheel for any radius within the range of the tool by using gage-blocks in connection with the Z-block. Zero and 90-degree marks are provided on opposite sides of the swivel-arm to indicate when the diamond has been swung through a 180-deg. arc. The illustration shows the Model "O" Dresser, wrench for the socket head clamping screws, Z-block, 0.500 in. set-up block, and sample of work produced by grinding wheels dressed with the Universal Radius Dresser.

MONARCH STUD DRIVER



—is made in a variety of shanks such as round, hexagon, etc., for any machine drive. Also fits any standard ratchet wrench and is the ideal tool for limited working space.

Used in driving studs in motorblocks, airplane and marine motors, boilers, locomotives, etc., —you'll find it as necessary as a wrench. Sizes from $\frac{1}{4}$ " to 2".

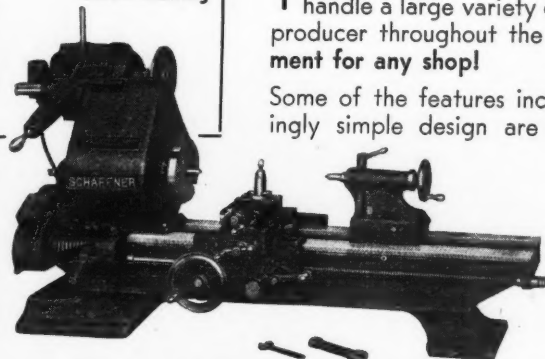
Send for Circular

MONARCH TOOL & MFG. CO.
2704 E. Larned St. Detroit, Mich.

4' Bed, \$278

5' Bed, \$295

Motor-Driven
Screw-Cutting



A Profitable Investment for ANY Shop

THE ability of the SCHAFFNER 11" LATHE to handle a large variety of work makes it a steady producer throughout the day . . . a good investment for any shop!

Some of the features incorporated in its exceedingly simple design are Gibbs V-Disc Transmission, seven spindle speeds, 40 feeds, thread cutting range of forty threads . . .

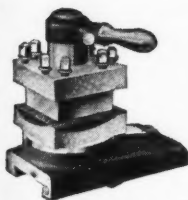
. . . and the initial cost is reasonable!

THE GENERAL RADIAL DRILL CO.

1765 ELMORE STREET

CINCINNATI, OHIO

STANDARDIZED LATHE TURRETS



STYLE "G"

Square head, for carrying four ordinary lathe tools.

8 Styles

12 Sizes

For any make or size of Lathe, old or new.

Ask for Circular No. 18

FAY & SCOTT

DEXTER, MAINE

DRILL VISE

With and Without Jig Attachments

3 sizes, 6", 9" and 12" jaws

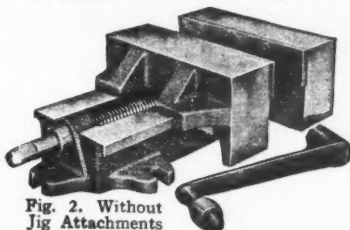


Fig. 2. Without Jig Attachments

A good one for general shop use on Driller, Miller, Shaper or Planer. Flanged all around bottom for bolting down, with three slots at large end not shown.

ANY VISE WILL PAY

THE GRAHAM MFG. CO.

69 Willard Avenue

Providence, R. I.



The ECLIPSE Multi-Diameter Cutter

—will go far toward reducing your operating costs and increasing your production by combining many machining operations.

For instance, the ECLIPSE Multi-Diameter Cutter shown *in action* is used for facing, counterboring and core drilling three diameters. The diameters of the cutters are 4-3/4", 2-33/64", and 2-1/16".

The economy of such a tool set-up is instantly apparent to the production man. The ECLIPSE Catalog describes many more similar cost-cutting tools. Send the coupon for your copy!

ECLIPSE COUNTERBORE CO.
DETROIT MICH.

ECLIPSE COUNTERBORE CO.
Detroit, Michigan

I'd like to see more of these cost-cutting tools. Send me a catalog.

Name.....Title.....

Firm.....

Address.....

City.....State.....

GUSHER COOLANT PUMP

There is a "GUSHER" for every machine tool regardless of type, of drive, capacity required or size.



Motor Driven

An outside installation model, equipped with a 3/4" intake and discharge, has a 1/4 horsepower motor and is capable of 5 pounds maximum pressure.

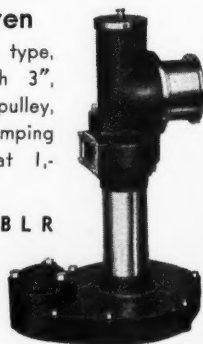
MODEL ULO

Belt Driven

An immersion type, equipped with 3", 5" or 7" pulley, capable of pumping 106 gallons at 1,000 R.P.M.

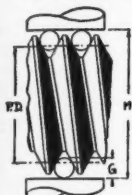
MODEL BLR

Write
for
Catalog



**THE RUTHMAN
MACHINERY CO.**

532 East Front Street
CINCINNATI, OHIO

Thread Measuring Wires

Made to Bureau of Standards Specifications. We have over 250 sizes of measuring wires and reversible plug gages in stock. Circular W26 gives full data on measuring wires and their uses. How many copies do you want? Have you Catalog No. 28, showing Light Waves, Gage Blocks, Plug gages, Micro-meter laps?

THE VAN KEUREN CO., Watertown, Mass.

**GEARS IN STOCK**

Immediate Delivery

Gears, speed reducers, sprockets, thrust bearings, flexible couplings, pulleys, etc. A complete line is carried in our Chicago stock. Can also quote on special gears of any kind. Send us your blue prints and inquiries.

Write for Catalog No. 80

CHICAGO GEAR WORKS

769-763 W. Jackson Blvd., Chicago, Ill.

LUFKIN

TELESCOPING GAGES

Both telescoping plungers move in the head so the handle can always be located in the center of the tool. This is an exclusive feature and one which permits that perfect balance and feel so essential to accuracy.

SEND FOR CATALOG

THE LUFKIN RULE CO.

PRECISION TOOL DIVISION

SAGINAW, MICHIGAN

HAMMOND

OF KALAMAZOO

GRINDERS AND POLISHERS

Electrically Driven - Belt Driven
In a Complete Range of Sizes and Types

Hammond Machinery Builders

KALAMAZOO, MICHIGAN
FORMERLY HILL-CURTIS COMPANY

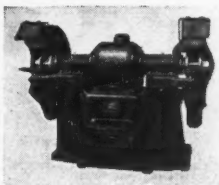
WRITE FOR CATALOG No. 20 - YOU'LL FIND IT INTERESTING



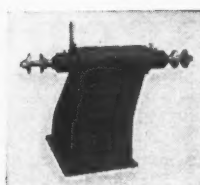
Combination Disc and Production Grinders, also Double Disc Grinders 2 to 10 H. P.



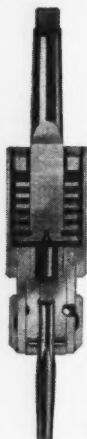
Tool and Production Grinders Bench and Floor Style. Sizes $\frac{1}{2}$ to $7\frac{1}{2}$ H. P.



Heavy Duty, 4 Bearing Snagging Grinders for Vitrified and Rubber Bonded, High Speed Wheels, 5 to 20 H. P.



Rite Speed Polishers. Made in 4 Types each, in sizes 3 to 20 H. P.



Pat.

*Get one, if it don't do what we say,
send it back.*

FACE TO FACE WITH FACTS

**You break taps
and other tools.**

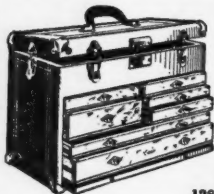
**We stop breakage.
Let us prove it.**

This chuck is also used for other operations, such as: Nut Setting, Stud and Screw Driving.

**Try it, let the chuck
tell the whole story.**

THE APEX MACHINE CO.
DAYTON, OHIO

BETTER TOOL CHESTS



for good tools
make the work
easier — save
your tools from
loss and damage.
A life time's service
at a low cost.

Catalog Free

H. GERSTNER & SONS
1287 Columbia St., Dayton, O.

Poldi Steel Corporation Issues Wall Chart for Steel Users

The Poldi Steel Corporation, 247 West 18th Street, New York, N. Y., has issued a wall chart on which are listed the common mistakes made in hardening, results of mistakes as shown on the tool, appearance of fracture, and suggestions for remedying the mistakes. The chart also offers recommendations for heating, tempering, the proper quenching bath, and describes the appearance of fractures of tool steel in the natural state, after being properly hardened, after being badly hardened, and so on. A copy of this chart will be sent without charge to any user of tool steels.

Nibbling Machines

An 8-page bulletin of Andrew C. Campbell, Inc., Bridgeport, Conn., gives specifications of and illustrates three designs of nibbling machines which they manufacture, for complicated cutting operations in sheet metal up to 1/2 in. thickness. Typical cutting and trimming operations both internal and external are given to illustrate some of the cuts that can be made and their neatness.

RIVETT COLLETS

"The finest collets in the world."
Full stock, at all times standard styles including Rivett, Hendey, Cataract, Seneca, Becker, etc.



Write for new
Bulletin.—100-AM
"Rivett Draw-in Collets
and Chucks"—also price list

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**LATHE AND
GRINDER CORP.**
Brighton Dist., Boston, Mass.

GROBET SWISS FILES



FOR ILLINOIS FILING MACHINES

GROBET SWISS FILES are precision files of high cutting speed, unexcelled for durability. They are required by every manufacturing line where accuracy in filing is essential.

Grobet Swiss Files are made in nine numbers of cuts: Nos. 00, 0, 1, 2, 3, 4, 5, 6, 8. Ask for catalog K showing 3,500 different styles. Specialties: Files for filing machines—Illinois, Hartford, Oliver, Cochrane, La Porte, Thiel, Excel, etc.

GROBET FILE CORP. of America

3 Park Place, New York City

Improves Accuracy and Reduces Time!



The Mummert-Dixon Compound Spot Facer is the ideal tool for machining small bosses because it combines both roughing cutters and finishing cutters in one tool.

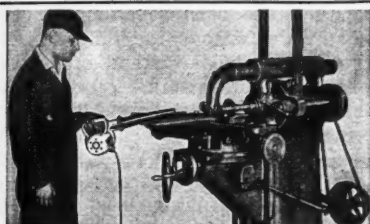
The serrated roughing cutters quickly and easily remove the hard scaly surface cutting the work to approximate size, and are withdrawn without stopping the machine.

Then, the finishing cutters shave off the serrated surfaces and finish the boss to accurate size.

The result is an accurate and smooth surface obtained in less than half the time required by other methods.

SEND FOR BULLETIN

MUMMERT-DIXON CO.
120 Philadelphia St. Hanover, Penn.

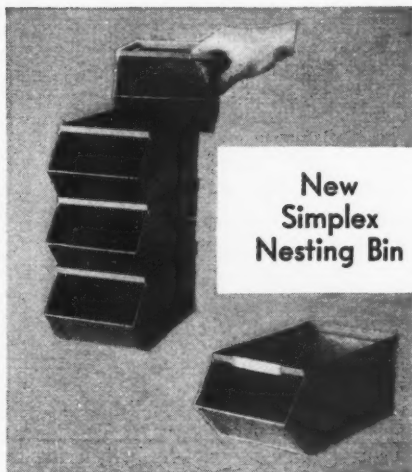


WE WILL SEND YOU THIS BLOWER ON TEN DAYS' FREE TRIAL

THE TORNADO Portable Electric Blower is the ideal all-purpose maintenance tool for machine shops. It is used for blowing, spraying insecticides, or as a handy vacuum cleaner. Hundreds of machine shops are finding it a time and labor saver for blowing away turnings, borings and grindings, blowing dust and dirt out of machinery and motors, painting, exterminating vermin and cleaning up floors, walls, pipes and office rugs.

Let us send you one for ten days free. Write at once

BREUER ELECTRIC MFG CO
483 BLACKHAWK STREET
CHICAGO ILL



New
Simplex
Nesting Bin

NOW PARTS CAN BE STACKED AND STILL BE ACCESSIBLE!

THE new Simplex Nesting Bin can be stacked several high, and unlike boxes, contents are easy to get at. Parts in bins are also easy to find because they are visible.

Bins nest deeply into one another. No amount of vibration will unstack them. They must be lifted out of each other.

Ideal for assembly, and destined to make old assembly methods obsolete. Place many parts within easy reach of assembler.

Make weighing practical for inventory purposes. Provide an expanding and contracting stockroom. Made in four standard sizes.

| Bin No. | Width | Height | Length |
|---------|-----------|-----------|------------|
| 1 | 5 1/4 in. | 4 in. | 12 in. |
| 2 | 7 1/2 in. | 5 1/4 in. | 15 in. |
| 3 | 9 in. | 6 1/4 in. | 18 1/4 in. |
| 4 | 12 in. | 9 1/2 in. | 20 in. |

Special sizes furnished to meet individual requirements.

SIMPLEX TOOL CO.

WOONSOCKET RHODE ISLAND

SIMPLEX TOOL CO.,
Woonsocket, R. I.

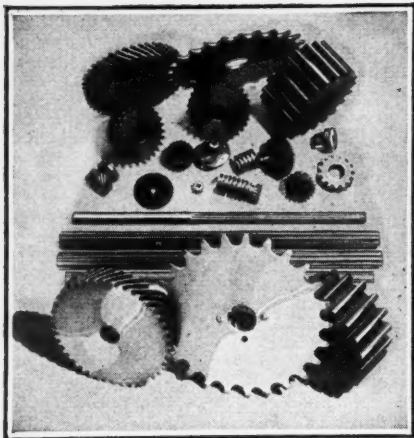
Kindly send descriptive circular and quote prices on Simplex Nesting Bins.

Name.....

Title.....

Firm.....

Address.....



For
Better Machine Service
Look To Your Gears!

THEY may seem like less important details in machine construction, but it is a fact that the design, quality, accuracy of your gears greatly influence the operating efficiency and durability of your machines.

M-C Gears (standard or special), M-C Sprockets, Hobs, Pinion Rods are made to standards that enable you to equip your machines with the best in gearing, economically.

Send for details, let us estimate on your gear needs.

MEISSELBACH-CATUCCI MFG. CO.
 70 STANTON ST. NEWARK, N. J.

M-C GEARS

Machinability of Metals

(Continued from page 44)

ant but using an air blast, or air suction. The next classification is known as aqueous, or water solutions, using ordinary water, or water plus an alkali. The third classification includes emulsions, soluble oils and compounds. Under the fourth classification comes oils, and under oil they have the fixed oils, the mineral oils, the compounded or blended oils, the sulphurized mineral oils, the sulphurized lard oil base, and the mineral oil, with oleic acid. We have found that the cutting oil or cutting fluid is a very important factor to be considered in machining. In our plant we made a very thorough investigation about three years ago, and finally adopted the following oils as best suited for our various requirements:

For the majority of our machine jobs, except lathe turning and thread milling, we use sulphur base oil. We buy the sulphur base material and mix the base with seven parts of a good grade of machine oil. . . . For our tougher jobs, instead of mixing seven parts of machine oil with one part of the sulphur base oil, we use four parts of the machine oil with one part of base and one part of kerosene. On production lathe turning we use an ordinary emulsion oil, mixed with twenty parts of water. For thread milling we use what we call the amber fluid. This oil contains a little over one per cent of sulphur and is clear and light in color.

You might be interested in the practice of a large aircraft company in regard to the various cutting oils used. For machining aluminum, they use a high-grade fuel oil, light in color. A sulphur base oil is used for turning steel, as well as for threading, reaming and milling operations. A paste properly mixed with water is used for turning brass and bronze.

One of the plants I heard about re-

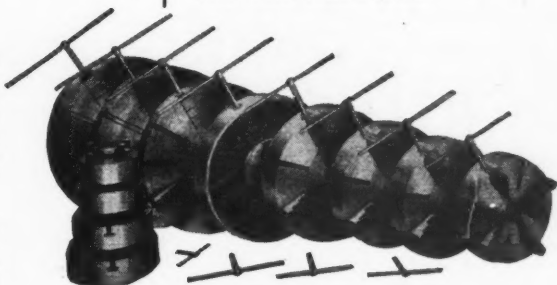
WHITON LATHE CHUCKS

**For
a Sure Grip!**

WHEN work must be held rigidly and securely for accurate machining at top speeds—WHITON Lathe Chucks prove their superiority!

WHITON Chucks—and there's one for every requirement—are good chucks. Their design and workmanship assure you dependable service over a long period of time.

Get a WHITON Catalog—it shows the complete line of WHITON Chucks as well as many special chucks built for special requirements.



Here is a group of WHITON Steel Body Independent Chucks designed to hold heavy work under heavy cuts at high speed. The one-piece body resists sudden strain.

**THE D. E. WHITON
MACHINE CO.**
NEW LONDON CONN.

Even on large work . . .

G. K. LATHES ARE CHATTERLESS!

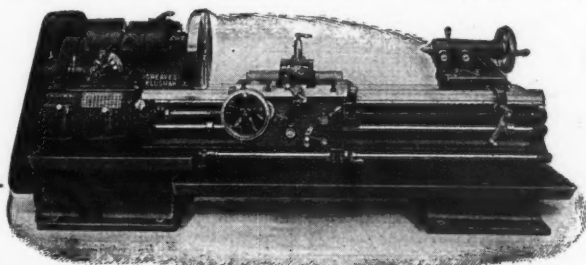
PRODUCTION MEN specify G. K. Single Control Lathes in order to get a tool that is absolutely chatterless on all work.

And, G. K. Lathes are chatterless because the offset between the spindle and the center line

of the bed insures the correct tool pressure angle on all work. Even on large jobs, tool pressure reacts on the inside of the front vee.

The G. K. Catalog outlines many more features . . . write for your copy today!

**BUILT
IN SIX
SIZES**



**BELT OR
MOTOR
DRIVE**

THE GREAVES-KLUSMAN TOOL CO., Cin'ti, O.

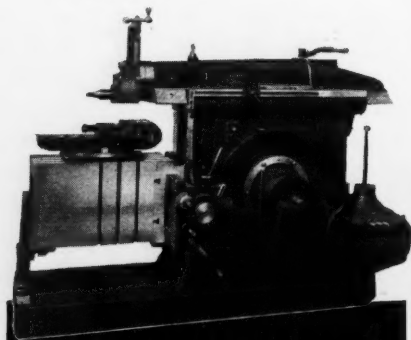


*Saves
Valuable
Time*

TIME is valuable—reduce the operating time on an operation and you lower costs! The COLUMBIA SUPERIOR SHAPER allows your operator to speed up his work and save time in finishing the job.

Centralized control, cross rail locked by one handle, extra large table to facilitate placing and clamping the work, quick stroke adjustment, patented quick-change feed, convenient and substantial table support are among the features which enable the COLUMBIA SUPERIOR SHAPER to Save Valuable Time for you.

BULLETIN 17 OUTLINES MANY MORE FEATURES—WRITE FOR IT TODAY!



**THE COLUMBIA
MACHINE TOOL CO.
HAMILTON, OHIO**

cently had a very interesting experience in regard to cutting oil. They were using a certain type of oil on a tough machining operation, and one day the oil caught on fire. They hurried and obtained a fire extinguisher, putting the fire out by blanketing the flames with the carbon tetrachloride. They continued the machining operation, and obtained a better finish, so at the present time they are using cutting oil diluted with carbon tetrachloride and obtaining good results.

Mr. Flanders, a prominent member of the A. S. M. E., stated at a recent A. S. M. E. meeting that his company made a die head with Acme thread chasers for a concern in the Middle West. They tested the die head before it left their plant on material supplied by the customer and obtained a very satisfactory thread, with a good finish. As soon as the customer received this die head they placed it in service, but obtained a very unsatisfactory finish on the pieces. After a careful study by a representative of Mr. Flanders' company, they decided to change the type of cutting fluid used by the customer, resulting in a very satisfactory thread.

The last factor to consider is the mental attitude of the machine operator. You gentlemen probably know—a lot of you have been machinists in your time—that if you are used to handling a certain type of material, you kind of resent a change in the type of material, especially if you are working on a piece-rate proposition. You know you are making good money at the prices set on a certain job, and as soon as a new kind of material is introduced feel as though it is going to reduce your income. One is, therefore, liable at times to receive a report stating that the new type of steel is not satisfactory for machining; a fair test not being given the new material.

Design
in the
W

THE R

Columbia TOOL STEEL

CLARITE HIGH SPEED STEEL
OILDIE NON-SHRINKING
COLUMBIA SPECIAL CARBON
TOOL STEEL
COLUMBIA EXTRA, ETC.

*It pays to use
Good Tool Steel.*

COLUMBIA TOOL STEEL COMPANY

MAIN OFFICE AND WORKS

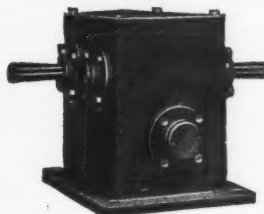
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CHICAGO DETROIT NEW ORLEANS ST. PAUL
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DENVER MILWAUKEE ST. LOUIS WORCESTER

2500-1

is a standard ratio of reduction in



SPEED REDUCER, No. 4D



Send for Catalog No. 25

Winfield H. Smith, Inc.

30 EATON STREET
SPRINGVILLE, ERIE CO., NEW YORK

RAHN-LARMON EXTENSION BED GAP LATHE

Swing 16/32", 18/36", 20/40"



Designed for general work in all types of shops. Has ample power to turn full diameters in the gap. By sliding the top bed gap can be varied to suit the requirements of the work. With gap closed is regular engine lathe. Belt driven or all geared motor drive.

WRITE FOR CIRCULAR AND FULL INFORMATION

THE RAHN-LARMON COMPANY, 2935 Spring Grove Ave., Cincinnati, Ohio.

For Your Catalog Library

Check any of these useful publications that you want, write your name, firm name, title, and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation. Please restrict your list to not more than ten.

Grinding Tungsten Carbide Tools: Instructions on grinding tungsten carbide tools, including directions as to angles, types, grades, and grains of wheels, wheel speeds, and so on, are included in a folder that can be obtained without charge by addressing Abrasive Company, Tacony and Fraley Streets, Philadelphia, Penna.

High Speed Tapping: The various types of Alto Motor-Driven, High Speed, Self-Contained Tapping Machines are described and illustrated in a series of folders that have been issued by The Alto Manufacturing Co., 1648-52 Wolfram St., Chicago, Ill. Free upon request.

Ames Gages: Catalog No. 50, issued by the B. C. Ames Company, Waltham, Mass., contains complete descriptions and illustrations of the dial gages, gage heads, upright gages, cylinder gages, dial micrometers, and precision verifiers, special gages and attachments made by this company. Copy free upon request.

Steel Furniture for the Shop: The complete line of steel furniture made by the Angle Steel Stool Co., Plainwell, Michigan, including steel stools and chairs, steel foremen's desks, lockers, tables, tool stands, machine tenders, shop boxes and pans, iron bar racks, trucks, bench legs, and bench drawers, is described and illustrated in Catalog "C," which is issued free to machine shop executives.

Stop Tap Breakage: A booklet that tells how to stop the breakage of taps, reamers, and other tools, by the use of a friction chuck, also how to use the chuck for setting studs or nuts, has been issued by The Apex Machine Co., 200 Davis Ave., Dayton, Ohio. Sent free upon request.

"Steelgrip" Universal Puller: Gears, wheels, or pulleys can be removed from shafts, regardless of the distance from the ends, by the aid of a puller that is made by Armstrong-Bray & Co., 688 Eagle Street, Chicago, Ill. Bulletin on request.

Machine Shop Accessories: Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

Hold Odd-Shaped Pieces Securely: A vise in which odd-shaped work can be held securely without the need of special jaws or fixtures is described in a folder that has been issued by The Avey Drilling Machine Co., P. O. Box 487, Cincinnati, Ohio. Copy free upon request.

Hobs and Milling Cutters: A complete line of milling cutters and hobs for cutting all kinds of gears, splines, sprockets and other forms is described in Catalog G, issued by the Barber-Colman Company, Rockford, Ill. Descriptions and illustrations of the Barber-Colman hobbing machine and hob-sharpening machines are included. Sent free on request.

All-Geared Drilling and Tapping Machines: A catalog describing in detail the various types of all-geared, self-orienting, drilling and tapping machines made by the Barnes Drill Co., 801-851 Chestnut Street, Rockford, Ill., will be sent free upon request.

Modern Drilling Equipment: Circulars describing the various types and sizes of Barnes upright drills, multiple drills and horizontal drilling machines made by this company have been issued by the W. F. & John Barnes Co., Rockford, Ill.

Automatic Oiled Die Sets: The automatic oiled die sets, die shoes, punch holders, leader pins, bolster plates, bushings, and other standard die parts made by the E. A. Baumbach Manfg. Co., 1806 S. Kilbourn Ave., Chicago, Ill., are described in Catalog No. 5, which has been issued by that company. Sent free upon request.

Bradford Precision Lathes: Precision Lathes for the tool room and for general manufacturing purposes, all-geared and cone types, belt or motor driven, are described and illustrated in a catalog that is issued by The Bradford Machine Tool Co., 657-671 Evans St.,

Cincinnati, Ohio. The catalog also includes descriptions of taper, relieving, turret and other lathe attachments. Sent free upon request.

How To Sharpen Staggered Tooth Cutters, Helical Milling Cutters, and Two-Lipped End Mills: A series of pamphlets on these subjects can be obtained without charge by addressing the Brown & Sharpe Mfg. Co., Providence, R. I.

Disc-Inspected Tool Steels: A bulletin discussing the advantages of disc-inspected tool steels can be had by writing to The Carpenter Steel Co., Reading, Penna.

Gears Of All Kinds are described and illustrated, with specifications, in Catalog 90, which has been issued by the Chicago Gear Works, 105-9 S. Jefferson St., Chicago, Ill.

Mounted Grinding Wheels: Grinding wheels for use in small holes such as are to be found in bushings, dies, gears, etc., mounted and ready for use, are described in a bulletin that can be had by addressing the Chicago Wheel & Mfg. Co., 110 S. Aberdeen Street, Chicago, Ill.

Electric Tools: The complete line of "The Cincinnati" Electric Drills, Grinders, Buffers, etc., manufactured by the Cincinnati Electrical Tool Company, Cincinnati, Ohio, is fully described and illustrated in their new catalog. Free upon request.

Bolender Gear Burnishers: Gears will operate more smoothly and more silently if burnished. Full description of the Bolender Gear Burnisher can be had by addressing the City Machine & Tool Works, Third and June Sts., Dayton, Ohio.

Handbook For Drillers: The Cleveland Twist Drill Co., 1242 E. Forty-ninth St., Cleveland, Ohio, has published a book in which the various parts of the twist drill are described, and which tells how to grind a drill correctly. The troubles that result from incorrect grinding are described and illustrated and several chapters are devoted to the subjects of speeds, feeds, materials, cutting compounds, and so on. Sent free upon request.

Columbia Superior Shapers: Bulletin No. 17, issued by The Columbia Machine Tool Co., Hamilton, Ohio, describes and illustrates the line of heavy duty shapers made by this firm. Copy free upon request.

Tool Steel Handbook: This book, published by the Columbia Tool Steel Company, 550 E. 14th Street, Chicago Heights, Ill., contains descriptions and information as to correct use of tool steels. Also hints on how to avoid hardening failures, with information on heat treating methods and valuable information tables. Copy free upon request.

Comtorplugs: Interchangeable plugs for internal gaging, from .250 in. to 8 in. dia. and up to 24 in. in length, graduated by an amplifier to .0001 in., are described and illustrated in a circular that has been issued by The Comtor Company, Waltham, Mass. Copy free upon request.

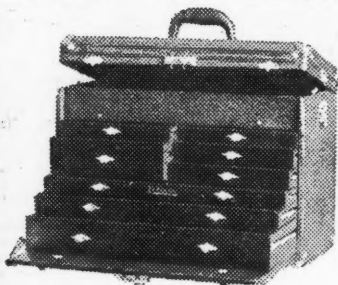
Motorize Your Cone Pulley Lathes: An attachment that can be applied to your lathe with four bolts makes it possible to motorize and modernize your lathes. Write for information to Cullman Wheel Co., 1336 Altgeld St., Chicago, Ill.

Grinding Wheel Dressers: All of the different types of grinding wheel dressers made by the Desmond-Stephan Mfg. Co., Urbana, Ohio, including Desmond-Huntington, Desmond-Sherman, Zig-Zag, Diamo-Carbo, and diamond dressers, are described and illustrated in a catalog that has been published by the firm mentioned. Free upon request.

Precision Grinding: A booklet which describes and illustrates the most modern methods of performing all kinds of precision grinding operations, showing how the Dumore grinder can be applied to various kinds of machine tools, has been published by The Dumore Company, Racine, Wis. Copy free upon request.

Interchangeable High Production Tools: Catalog No. 28, issued free by the Eclipse Counterbore Co., 7410 St.

MACHINISTS AND TOOL-MAKERS TOOL CHESTS

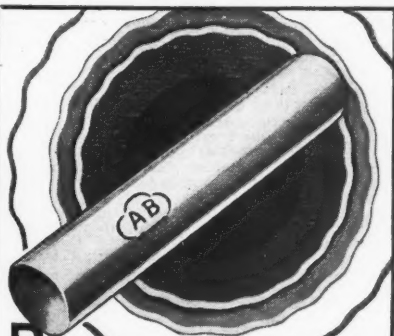


Tool Chests that are right in construction and price.

Send for No. 25 Catalogue of Tool Chests and Tools.

WATERSTON'S

420 Woodward Avenue
DETROIT, MICH.



Representing YOU

YOUR name, trade mark or other insignia marked or stamped on your goods adds value to your products and helps maintain their markets.

It is with the viewpoint that this marking is to be your representative that Schwerdtle builds finer, stronger, better steel stamps and dies.

Your request for additional information or quotation will receive our prompt attention.

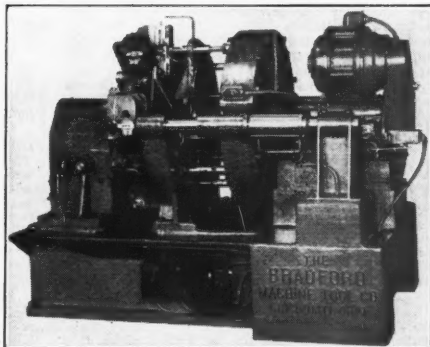
THE SCHWERDTLE STAMP CO.
11 CANNON STREET BRIDGEPORT, CONN.

Bradford Automatic Drilling Machine

*Adapted for Drilling
and Taper Reaming
Golf Heads*

Machine shown here made up of Bradford Standard Unit Type Head and Bradford Multi-Spindle head for the following operation: Drilling Golf Head Steel Forging in six stages and Taper Reaming in one stage $2\frac{1}{4}$ " deep—Feed and Index Control fully automatic—Time for each piece $10\frac{1}{2}$ seconds.

Let Bradford help you increase your production and cut your costs.



SEND US YOUR BLUE PRINTS

The Bradford Machine Tool Company
659 Evans Street
Cincinnati, Ohio

Aubin St., Detroit, Mich., describes and illustrates the interchangeable counterbores, spot facers, and form cutters, and other end cutting tools made by this firm.

Grooved Cast Iron Pulleys: All sizes of grooved cast iron pulleys, made by Efficient Machine Shop, 147 Baxter St., New York City, are listed in a circular that can be had by writing this firm.

X-L-O Drill Jig Bushings: A catalog describing the full line of tool steel drill jig bushings manufactured by the Ex-Cell-O Aircraft & Tool Corporation, 1202 Oakman Blvd., Detroit, Michigan, together with an engineering specification sheet giving all dimensions, limits, and so on, that are necessary for the draftsman in laying out jigs and fixtures will be sent free to mechanical executives.

"Ramet" Cutting Metal: A cutting metal which is neither a steel nor a composition of tungsten and cobalt, but which is said to cut alloy steels, manganese steel, or any other metal composition, is described in a folder that will be sent free upon application to Faststeel Products Co., Inc., North Chicago, Ill.

Lathe Turrets of eight different types and twelve sizes are described and illustrated in Circular No. 18, issued by Fay & Scott, Dexter, Maine. Copies free upon request.

Precision Measuring Instruments: The latest types and models of dial indicators, thread lead test gages, pitch gages, thickness gages, dial comparators, and other precision measuring instruments marketed by the Federal Products Corporation, Providence, R. I., are described and illustrated in a book that will be sent free upon application to this firm.

The Involute Gear Simply Explained: A direct, clear explanation of the theory and principles of involute gearing without the use of higher mathematics can be obtained without charge by addressing The Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

Questions To Ask Before Buying a Jig-Boring Machine: A list of the fine points to look for in a jig-boring machine, with descriptions and illustrations of the working parts of the Swiss Jig Borer, can be obtained free by addressing The R. Y. Ferner Co., 1511 K St., N. W., Washington, D. C.

Gear Checkers: Gear can be checked from the pitch line by the use of a chuck that is made by the Garrison Machine Works, Inc., Dayton, Ohio. Descriptive booklet free upon request.

The Schaffner 11-In. Lathe is described and illustrated in a bulletin which can be obtained without charge by addressing The General Radial Drill Co., 1767 Elmoro Street, Cincinnati, Ohio.

Adjustable Blade Cutters: Hollow mills, facing tools, face mills, milling cutters and other production tools with adjustable, interchangeable blades are described and illustrated in a booklet that is issued free by the Genesee Manufacturing Co., 141 N. Water St., Rochester, N. Y.

Take Care of Your Tools by keeping them in a convenient, strong, and fine-looking chest. A catalog of tool chests, complete with descriptions and illustrations, can be had by addressing H. Gerstner & Sons, 1283 Columbia Street, Dayton, Ohio.

Simplify Your Tooling Problem by using Swartz standardized jigs and fixtures. A step forward in production methods. Ask for complete catalog. Address Geo. A. Gloor Company, 6442 Epworth Blvd., Detroit, Michigan.

Engraving and Die Sinking Time can be reduced to minimum by the use of a Gorton Universal Die Sinking and Engraving machine, made by George Gorton Machine Co., 1101 13th Street, Racine, Wis. Bulletin free upon request.

Machine Vises of all sizes for use with machine shop equipment are described in a circular that will be sent free upon application to The Graham Mfg. Co., 69 Willard Ave., Providence, R. I.

Graeves-Klusman Lathes: A book containing complete descriptions of the latest types of lathes made by this firm has been issued by the Graeves-Klusman Tool Co., Oakley, Cincinnati, Ohio.

Swiss Files: The complete line of Grobet Swiss Files for use in die and tool work or for other fine work is described and illustrated in Catalog "K," published by the Grobet File Corporation of America, 3 Park Place, New York, N. Y. Copy free upon request.

Grinding, Polishing and Buffing Machines of the latest types are described and illustrated in a series of bulletins that have been issued by the Hammond Machinery Builders, Kalamazoo, Mich. Copies free upon request.

Texdride Grinders for Vitrified or High Speed Wheels: A six-page bulletin No. 43 describes in detail and illustrates the advantages of the new Hisey Texdride Grinder—stressing especially the multi-speed and single-speed machines. Write for a copy to The Hisey-Wolf Machine Co., Colerain and Marshall Sts., Cincinnati, O.

Precision Bench Lathe Work can only be done on finely-built, accurate machines. The complete line of Hirth Precision Bench Lathes is described and illustrated in a catalog that has been issued by Hirth Lathe & Tool Company, 24 School Street, Boston, Mass. Copy free upon request.

"Quick-As-Wink" Buffing Wheels that eliminate all disadvantages of rag-buffs, speed output, do better work, and cut buffing costs to the minimum are described in a bulletin that is issued free by C. B. Hunt & Son, 639 McKinley Ave., Salem, Ohio.

Useful Tool Information: The Illinois Tool Works, 2503 N. Keeler Ave., Chicago, has published a catalog which describes and illustrates the standard and special cutters, mills, hobs, gear cutters, thread cutters, saws, reamers, and other tools made by this firm. The book also contains a number of useful tables and formulas. Copy free upon request.

Special Mill-Waukee-Mills of Standard Units: A milling machine of which the base, heads, columns, and other parts are built in standard units, thus enabling the user to order a machine that will be especially adapted for his job, is described and illustrated in Catalog No. 36, issued by the Kearney & Trecker Corporation, Milwaukee, Wis. Free to machine shop executives.

Keller Automatic Toolroom Machine for machining dies, metal patterns, jigs, core boxes, molds, and other irregular parts is fully described in a booklet that can be had free by addressing the Keller Mechanical Engineering Corp., 84 Front Street, Brooklyn, N. Y.

Koebel-Wagner Diamonds for Wheel Dressing: The Koebel-Wagner method of mounting diamonds and the use of the "Dykon" gage are discussed in a bulletin issued by the Koebel-Wagner Corporation, 144 Orange St., Newark, N. J. Free upon request.

Threading Machinery: Catalog No. 32, containing full descriptions of Landis threading machines, stay bolt threading machines, bolt factory threading machines, automatic forming and threading machines and chaser grinders can be had without charge by addressing Landis Machine Co., Inc., Waynesboro, Penna.

Flexibility in Cylindrical Grinding means increased production, need for less equipment, and lower costs. Send for information as to the advantages of Landis Hydraulic Grinders. Address Landis Tool Co., Waynesboro, Penna.

Cutter and Tool Grinding: A book that tells how to grind tools and cutters accurately and which also describes and illustrates the different types of LeBlond Universal Tool Room Grinders will be sent free upon request. Address, The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machine to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

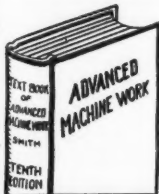
Rapid-Reading Micrometer: A new type of rapid-reading micrometer, designed to show the reading in numerals, is described in Catalog No. 5, issued by The Lufkin Rule Co., Saginaw, Michigan. The catalog also contains descriptions of the micrometers, calipers, gauges, scales, squares, bevel protractors, and other tools made by this company. Free upon request.

Time Saving Machine Equipment: How machining time can be reduced to the minimum by the use of Wizard chucks, collets and tap holders, turret tool posts, self-centering steadyrests, and other McCroskey Tool Corporation, Meville, Penna. Will be sent without charge.

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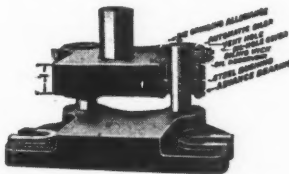
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Compound Spot-Facing Tool: A spot-facing tool retracting, serrated roughing cutters and fixed finishing cutters in the same tool will break up the scale easily and do accurate work. Write for bulletin to Mummert-Dixon Co., 120 Philadelphia St., Hanover, Penna.

"The Answer to Your Gear Problems": Information as to correct methods of cutting and finishing gears will be supplied without charge by The National Tool Co., Cleveland, Ohio. This firm also carries a complete stock of gear shaper cutters and markets the National-Cleveland Spur and Helical Gear Grinding Machine.

Save Time with Expanding Mandrels: How expanding mandrels will solve the problem of turning pieces with odd-size holes, and will increase production on duplicate work, is told in a folder that will be sent free upon request by W. H. Nicholson & Son, 138 Oregon St., Wilkes-Barre, Pa.

Gall and Roller Bearing Data Sheets: A complete set of data sheets showing all the dimensions and loads at given speeds, and giving instructions for mounting precision ball bearing and Hoffmann roller bearings, can be obtained without charge by addressing the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

How To Grind Cemented Tungsten Carbide: A booklet which describes and illustrates the correct methods of grinding tungsten carbide tools has been published by the Norton Company, Worcester, Mass. Copy free upon request.

"O. K." Tool System: The O. K. System for lathes, planers, shapers, boring mills, and other production machines consists of special forged steel holders with complete sets of tool bits of special design. Particulars can be had by addressing The O. K. Tool Co., Shelton, Conn.

Die Making Machines: How dies, templates, gages, etc., can be sawed out, filed, and lapped easily and accurately on Oliver die making machines is fully described in a bulletin issued by the Oliver Instrument Company, 1430 Maumee Street, Adrian, Mich. Mailed upon request.

"Fastenings" is the title of a booklet, issued by the Parker-Kalon Corporation, 192-196 Varick Street, New York, N. Y., in which are included the results of surveys made in fourteen different plants as to the efficiency of fastening methods. Copy free upon request.

"Most Frequent Mistakes Made in Hardening:" Users of steel can obtain a wall-chart on which are listed the most common mistakes made in hardening tool steels, results of mistakes as shown on the tools, appearance of fracture, and suggestions for remedying the mistakes, by writing to the Poldi Steel Corporation of America, 247 West 18th Street, New York, N. Y.

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Engine, Turret, and Gap Lathes are described in a series of bulletins that have been issued by The Rahm-Larmon Co., 2935 Spring Grove Ave., Cincinnati, Ohio.

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Economies in Material Handling: A volume of facts about planned load handling, with actual examples of economies in time, material, and labor costs that have been effected with Shepard electric hoists will be sent free upon request to Shepard-Niles Crane & Hoist Corp., 424 Schuyler Avenue, Montour Falls, N. Y.

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Simonds Files: A useful book on files showing the various styles made, their uses, cross-section, and cuts, and containing a number of reference tables and other information useful in a machine shop can be had by addressing Advertising Dept., Simonds Saw & Steel Co., 470 Main Street, Fitchburg, Mass.

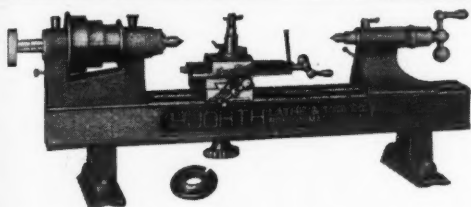
Simplex Nesting Bins: Bins which may be used as individual containers, as tote-boxes, or "nested" to form stock-room sections are described in an illustrated circular published by the Simplex Tool Co., Woonsocket, R. I. Copy free upon request.

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Speed and Accuracy in Straightening: The Springfield Straightening Press is an ideal tool for use in straightening any length or size of rough or finished work. Send for illustrated folder. Address The Springfield Machine Tool Co., 630 West Southern Avenue, Springfield, Ohio.

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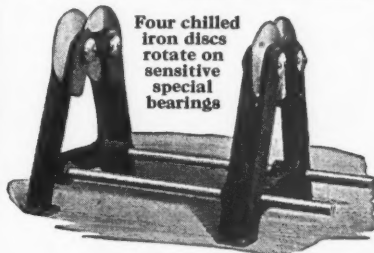
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Four chilled iron discs rotate on sensitive special bearings

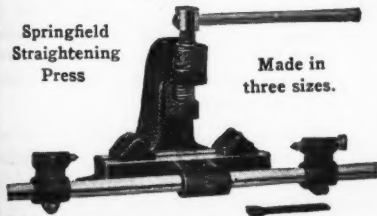
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Straightening
Press

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three sizes.



THE Springfield Straightening Press is the ideal tool for straightening any length of rough or finished work—truing sprung tools—testing and balancing cams, or crank shafts—and scores of other jobs.

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We also manufacture Engine Lathes and Shapers.

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Rigidmilling Principles and Practice: A book that shows how the Rigidmill can be adapted to various kinds of usual and unusual milling operations, and which describes in detail the work that can be handled by this machine has been issued by the Sundstrand Machine Tool Co., Rockford, Ill. Copy free upon request.

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Change drilling speeds instantly without stopping the machine or touching a belt. This can be done with the Victor Super-Drill, made by U. S. Automatic Box Machinery Co., Newtonville, Boston, Mass. Bulletin free upon request.

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Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, electric screw drivers, surface grinders, tool post grinders, and bench and floor grinders is described in Catalog No. 29, which has

been published by The United States Electrical Tool Co., 2471 W. Sixth St., Cincinnati, Ohio.

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Wetmore Adjustable Reamers: The exclusive features of the Wetmore Adjustable Shell Reamer are discussed in Catalog No. 29, issued by the Wetmore Reamer Co., 62 27th St., Milwaukee, Wis. Copy free upon request.

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Change Punches Without Removing Die: The user of Hercules Interchangeable Punches and Retainers can change punches without removing the die from the press. Information that will help to lower die-building costs, reduce lost time for repairs, and increase press production can be had by addressing Whitman & Barnes, Inc., Detroit, Michigan.

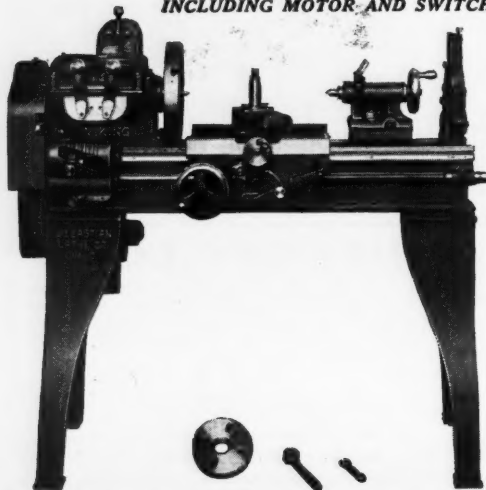
Whitton Steel Body Lathe Chucks: The various types and sizes of steel body chucks for lathes that are made by the D. E. Whitton Machine Co., New London, Conn., are described and illustrated in a booklet that will be sent free upon application to this firm.

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INCLUDING MOTOR AND SWITCH, F. O. B., CINCINNATI, OHIO

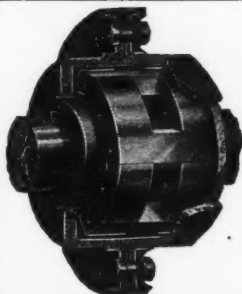


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(Cast Iron)
Pulleys**



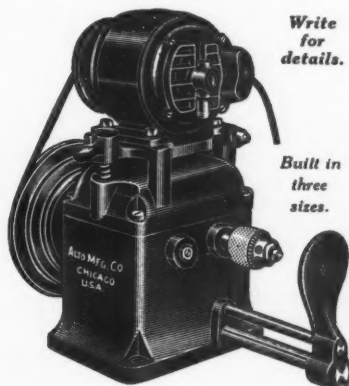
All Size Holes

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|---------------------------|----------------------------|
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| 3 | 1/2 5/8 3/4 |
| 4L | 5/8 3/4 1 |
| 4 | 3/4 1 1 1/4 |
| 5 | 1 1 1/4 1 1/2 |
| 6 | 1 1/2 1 3/4 2 |
| 8 | 1 3/4 2 2 1/4 |
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The best all-around Tool Room Dresser. The steel tube is filled with an extremely hard abrasive which is very durable and economical.

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The DESMOND-STEPHAN MFG. CO., Urbana, O.

THE SCRAP PILE

By GEO. ALEXANDER MANN



Speakin' O' Service

"I want a hard-boiled egg,
To take out," said he;
She said, "You'll havta wait,
I don't get off till three."

Many a sap who lives simply to get
a kick out o' life finally gets it just
where it belongs.

You Said Ut

Peaceful married life for the friend
Hub is simply a game o' give an'
take—givin' credit an' takin' blame.

Sure Sign

His wife is on the phone,
Believe me, I know;
All he's done is listen,
Since he said "Hello."

The best thing about good habits
is, they're as hard to break as the
bad ones.

Happy folks can't be mean any
more than mean folks can be happy.

Ah—Ha—Now It Comes Out

Dad refers to the Battle Creek
cereals as Jack Ass Chow—which
may explain the President invitin' the
Senators over for breakfast.

Hard?—Ut's Impossible

When the house is fulla smoke,
It's hard to tell or not,
Whether she's been smokin'
Or another husband's shot.

Better to have the grass growin'
under your feet than to have it grow-
in' over your head.

Keen Come-Back

"Don't act like a baby,"
He said to May;
She said, "I can't help it—
I was born that way."

A man's best friend is another man
with a sense o' humor.

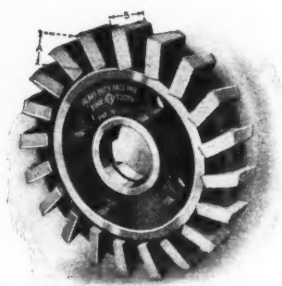
Foolish Ask No. 48762

"A campaign 'gainst malaria?
My goodness," said Howe;
"What have them devilish
Malarians done now?"

Many who love an' leave 'em havta
leave 'em plenty.

Heard at the Dawnce

"Why let him kiss you,
If you don't like the dude?"
"I don't guess I should,
But I just can't be rude."



"O. K."

Heavy Duty Face Mill

A production cutter of simple design, yet most efficient and economical.

Diameter can be maintained if necessary.

Stocked in diameter 8" and up to fit standardized spindles.

Remember—only the "O. K." System uses serrated, self-aligning blades. No fussy locking devices. Blades quickly removed, quickly inserted—and they stay put!

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— THE  TOOL —
CO., INC.
SHELTON, CONNECTICUT

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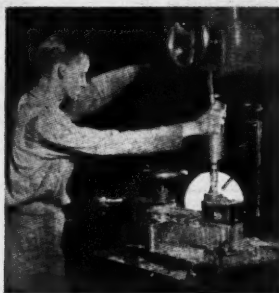
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Société Genevoise catalogs 500, 502, 527, or 1001 on Swiss Jig Boring Machines if you have dies, jigs, fixtures, molds, or special parts to drill and bore.

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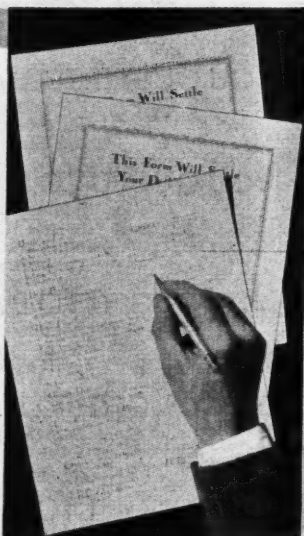
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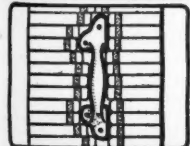
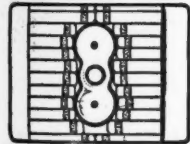
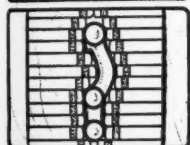
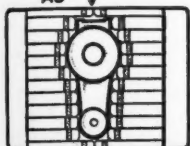
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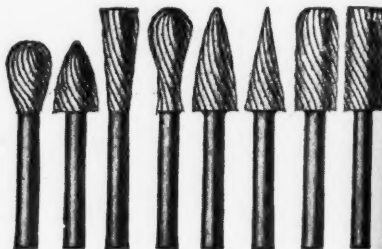
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